

AN INTERIOR VIEW OF A MODERN ENGINEERING WORKS

Photographed

AN INTRODUCTION TO THE PRINCIPLES OF INDUSTRIAL ADMINISTRATION

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PREFACE

AS elementary general knowledge of the underlying principles of administration is useful to all persons engaged in industrial employment. More particularly is such information essential to those who are undergoing some form of training designed with the object of fitting them ultimately to occupy positions of responsibility in industry. Equally important is a knowledge of the fundamentals of industrial organization to those who, while not actually engaged in industry, are nevertheless affected by the manner in which it is conducted.

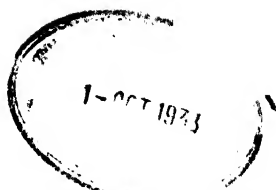
An attempt is made in the following pages to present in simple form that general survey of industry which such students require, and which is an introduction to the study of more specific aspects of the problem.

The volume is therefore addressed to students of industrial technology, both in universities or technical colleges, and in industry; to students of economics and sociology; to teachers in evening schools, continuation schools, and works schools who desire to know something of the conditions under which their students in industry are employed; to supervisory members of industry, such as foremen and inspectors; and to working men and women who wish to study either privately or through the medium of study circles, the general organization of modern industry.



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AN INTRODUCTION TO THE PRINCIPLES OF INDUSTRIAL ADMINISTRATION

CHAPTER I

THE FUNCTION AND CHARACTER OF INDUSTRY

By an old interpretation the meaning of the word "industry" was limited to the "making" of something, but to-day the word has a wider significance, and as applied to trade or manufacture it broadly signifies all operations in the production of materials and goods for human consumption and welfare. Its branches correspond to the nature of the product yielded, and as typical industries one may cite the *agricultural* industry which relates to the raising of crops, the tilling and planting of the soil, the cultivation of fruit, the production of milk and dairy commodities; the *textile* industry which relates to the spinning, weaving and printing of cotton and other fibres; the *engineering* industry which relates, among many other operations, to the casting, rolling, forging and machining of metals, and the use of these materials in the construction of boilers, engines and machinery; the *transport* industry which relates to the haulage of goods by railway, canal, road, river, sea and air.

The dyeing, chemical, steel, motor-car, ship-building, leather, printing, paper-making and kindred industries are spoken of as "manufacturing" industries to distinguish them from agriculture, mining, power-supply, transport and like industries where labour is expended otherwise than in actually making things.

Great Britain is spoken of as a "manufacturing" country, indicating that extensive industries of the "manufacturing" type are carried on here, as compared with such countries as Argentina, Brazil, Canada and Australia, where the inhabitants are mainly concerned with the raising of crops, the production of timber, the rearing of cattle and working of mines, the products of their industry being transported to provide raw material for those countries which, like our own, are principally engaged in the manufacturing industries.

The prosperity of every person in a manufacturing country depends essentially upon the healthy state of its industry. While it will be apparent that the livelihood of those directly engaged in industry is determined largely by the abundance of their remunerative work, it is not so easy to appreciate the manner in which the lawyer, doctor, bank clerk, post office official or retail dealer are affected by its fluctuations. Nevertheless these workers are indirectly vitally concerned, as will readily be understood when the function of industry and the interdependence of a modern community are carefully considered.

FUNCTION OF INDUSTRY

In its very elementary explanation industry consists merely in the transformation of some natural raw material into a product suited to human requirements. Thus, raw cotton passes through a variety of processes, including picking from the plant, packing, transporting, spinning and weaving, and such further treatment as bleaching, finishing, calendering, printing, until it is fully transformed into cloth for human use. Similarly, wool from the sheep, leather from hides, paper from pulp, ships, locomotives, bridges, cutlery and machinery principally from iron ore, pottery from clay, linen from

flax, all pass through a series of processes which transforms raw material to finished products. Each sequence of processes constitutes a branch of manufacturing industry.

THE INTERDEPENDENCE OF INDUSTRIES

The prosperity of one industry is shared ultimately by other industries, since all are to a greater or lesser extent interdependent. For example, the spinning and weaving of cotton requires machinery and a considerable amount of power plant to drive it. This want is supplied by the engineering industry. The engineer depends for his raw materials mainly upon the iron and steel industries, and the power for turning the machinery of the engineer, the looms and spindles of the textile workers, originates from the coal supply. Any increase in business or in the equipment of new factories in the textile industry thus affects the engineering and mining industries, increasing their prosperity by creating a greater demand for labour and material.

The development of a new industry resulting from a new scientific discovery enhances the prosperity of the whole community and clearly substantial benefits accrue to the general public from the development of such new industries as the motor-car, aircraft, wireless telegraphy and telephony and dyeing industries.

Obviously the converse is true. Prior to the war steel-making was gradually passing into the hands of foreign competitors. English steel foundries were closing down, with the result that the skilled labour had to turn to less highly skilled occupations, and consequently the value of their industry to the nation was diminished. Manufacturers of plant for steel-making experienced a reduced demand for their

products ; the transport industry engaged in hauling raw and finished steel products lost much of its internal traffic ; and in like manner the collieries and industries engaged in by-products of coal were detrimentally affected.

INDUSTRY AND THE INDIVIDUAL

Just as industries are mutually interdependent, so also are the workers in industry. Nearly all workers of a similar trade or occupation belong to the trade union representing their craft or industry ; thus there are unions or societies of Moulders, Engineers, General Workers, Dockers, and so forth. The stoppage of the workers of one union or craft, either due to shortage of work or on account of dispute, ultimately involves a stoppage of all other workers. A similar state of affairs would develop if the draughtsmen, salesmen, or technical and management staffs of an industry withdrew their labour.

Apart from those directly engaged in industry, all other members of an industrial community fulfil a two-fold function, acting in the first place in some measure as producers in order that they may earn a livelihood, and in the second as consumers of the products of industry, or services of others in the form of the necessities and conveniences of everyday life.

In early days, each family or tribe was able to supply its own wants which were of necessity of the simplest and crudest character, but industrial development through the centuries has enabled members of the modern community to avail themselves of an infinite variety of world-wide resources. As a natural consequence of this, each individual has in a great measure limited his capacity to satisfy completely by his own efforts his varied wants ; hence development of

industry makes for the greater interdependence of the members of a community.

INDUSTRY AND MARKETS

It has been noted that not all countries engage to any marked extent in manufacturing industry, but that some are primarily concerned with such pursuits as agriculture, mining, etc., and supply manufacturing countries with food supplies and raw materials in exchange for machinery, clothes and other manufactured articles. It is in this way—through the medium of the transport industry—that overseas trade is developed. An important outcome of this condition of affairs is that manufacturing countries support a much larger population than would be possible from agriculture and mining alone.

In the supply of manufactured goods to overseas markets there is very keen competition with other manufacturing countries of Europe, the United States and Japan, and it is only to the extent to which this country is able to supply goods of better quality and, either through efficiency of manufacture or transport facilities, of lower price than the goods of foreign competitors that the export trade, which is so vital to a country like Great Britain, can be secured.

INDUSTRY AND PRODUCTION

It has been already explained that a decrease in production in any one industry or a stoppage of work on the part of one section of the manufacturing community reacts detrimentally on all other industries, and, conversely, that increasing prosperity and business in one industry is shared ultimately by all. If, by improved machinery or more efficient methods of working, greater quantities of any commodity can be manufactured, increased demands follow for the

products of other industries. For example, the manufacture of a vastly increased number of motor-cars creates a demand for more machinery for producing them, more raw materials, such as rubber for tyres, steel for frame-work, engines, magnetos, etc. The supply of these in turn sets up more machinery of the special types used in these industries, more coal for steel production, more transport facilities, including improved roadways, trucks and locomotives. More power is needed in the factories, and consequently more mechanical power plant and electrical machinery has to be made. This expansion of business in so many directions increases the possibility of employment and general prosperity as long as markets for the increased number of products can be secured.

This condition obtains so long as the products can be manufactured at a cost that brings them within the economic reach of the general body of consumers, but if, through inefficiency in methods of production or extravagant wage charges, the market price of the goods is increased beyond this economic limit, the demand falls and industry stagnates until equilibrium is restored, since in considering the market price of products the prosperity of industry may be measured by the difference between the price at which the product is sold and the cost of raw materials, together with expenses incidental to manufacturing and selling.

Now one of the first effects of increasing production is to bring down the cost of manufacture, for reasons that will be fully explained later.

It is often asserted that there is only a definite amount of work to be done, and therefore any means of labour-saving so as to increase production must result in unemployment. It has consequently been the established custom of certain groups of workers to restrict their productive output. There would be some reason in this if the markets of the world or the raw

material supply were definitely limited, or if financial restrictions as applied to production and commerce were introduced.

Markets, however, for various reasons are continuously expanding. In the first place, the population in almost every country increases and with it grow demands for food, clothing and the amenities of life. Vast portions of the earth and their markets have been developed only to a very limited extent. With the advancement of civilization, higher standards of living and consequently new demands are created. Then again, along certain lines progress is extremely rapid, and what may at first be considered luxury becomes necessity. Nothing illustrates this more clearly than the modern demand for trams and motor-buses, motor-cycles and motor-cars, in place of the old-time practice of walking to work.

It is thus seen that *work creates work*, and as far as markets are concerned, there need be little fear of over-production, provided the cost of manufacture is kept within reasonable bounds; that there is "balanced" production, that is to say, not an abnormal amount of manufacture in one particular industry or of one kind of commodity; that international trade is not restricted by detrimental credit conditions which may result in inflated or depreciated rates of exchange; and that sudden changes in the purchasing value of money do not bring about the condition in which the high cost of manufacture coincides with a period in which purchasers are unable, despite their needs, to purchase at a price that yields a profit to the supplier. While from time to time a shortage of nature's supply of raw material threatens there are always substitutes to be found. For example, as the supplies of coal diminish, oil discoveries afford new fuel, and the development of means for distilling alcohol from vegetable products and combustible

gases from waste products assists in remedying the deficiency. No doubt means will be improved for obtaining directly the benefit of the sun's energy, and ultimately means of obtaining energy in a practical form, from atoms may be devised.

INDUSTRY AND SCIENCE

An industry is developed to the extent that new knowledge is applied in its processes. At first this new knowledge required for development comes from the everyday experience of its workers. The knowledge accumulated in other industries has then to be studied so that any information that can be usefully applied is taken advantage of. The growing knowledge of the arts gave birth to science. The experience and knowledge, for instance, acquired in connection with brewing and other domestic arts, gave rise to the science of chemistry. The blacksmith's art laid the foundations of the science of metallurgy. These sciences react to give impetus and progress not only to the arts and crafts of their origin but to all industry. With the ever widening fields of science, industry has been compelled to employ scientifically trained experts who could continually furnish new knowledge required for industrial progress. Industrial leaders are now no longer content to await the chance discoveries of science, but employ scientific research workers who devote their entire attention to investigations bearing on industrial problems and new scientific development.

In addition to this industrial research carried on with practical ends in view, men of science have continually made discoveries from which new industries arise. For example, the experiments of Faraday in connection with the magnetic effects produced by a current of electricity flowing in a wire led to the discovery of the dynamo, from which was developed practically the

whole of the modern electrical industry with its vast ramifications.

The chemical investigations into coal tar led to the discovery of many dyes, drugs and explosives. Each discovery serves as a starting point from which new discoveries radiate, each tending to the establishment of a new industry or branch of industry. It is, therefore, of the utmost importance that the application of science in industry should systematically be provided for, since by such means new industries and new uses for Nature's resources are determined.

INDUSTRY AND THE GROWTH OF THE COMMUNITY

To a considerable extent industries become localized. For example, porcelain and pottery ware is principally manufactured around Stoke in Staffordshire, the textile industry is very largely carried on in South Lancashire, the woollen in Yorkshire, the cutlery trade in Sheffield, and so on. Sometimes the location is determined by climatic conditions, sometimes by the supply of raw materials, or of fuel or power. In other cases handicraft skill is handed down from generation to generation, and certain localities acquire the reputation of possessing certain highly skilled labour.

The discovery of raw material supplies results in a demand for labour to obtain and work the raw material, and workers, thus attracted to a centre of raw material supply, congregate in large numbers and before long grow into a small community, and ultimately into a town with all the evidences of organized social life, including shops, trams, railway services, schools and churches. Thus industrial development produces a new community whose prosperity is largely governed by the prosperity of the local industries. If the industry fails through the raw material being worked out, the town decays, though, on the other hand, if a big labour force and extensive machinery have been

established to work a raw material, the supply of which fails in the immediate locality, new supplies are frequently brought from a remote area. Many English iron and steel works, for example, are supplied by iron ore from Spain.

Having considered some of the phases of modern industry, a study will now be made of the historical development of industry in order to understand through what steps it has grown to its present dimensions and state.

CHAPTER II

THE HISTORICAL DEVELOPMENT OF INDUSTRY

WHILE the present methods of manufacturing industry are of comparatively recent origin, several industrial processes were known and practised by early civilizations. In Babylonia and Egypt—the first civilizations of which we have any trustworthy information—houses, temples, embankments and canals were constructed, the art of the potter was highly developed; and in Egypt especially, flax was woven into linen, and paper made from the papyrus plant that grew freely along the banks of the river Nile.

With the decline of these early peoples, the Greeks and Romans became ascendant. While the former are more famous for their literary and philosophic achievements, the Romans have become known as the founders of the modern sciences of civil and mechanical engineering. They possessed great military strength and conquered every land they entered, but always left behind constructive work, the remains of which are still the silent but impressive witnesses of their particular genius. In many parts of England there are the remains of Roman roads, of walls that once encircled cities, and of encampments, and in France many Roman viaducts are still to be found.

POWER AND ITS APPLICATION

To illustrate the historical development of industry it is proposed to analyse its growth in Britain, and to trace its development, considering in the first place sources of power and their application—for the story of industry is virtually the story of the change of power applied, from hand to water and wind, steam and electricity—and in the second place the evolution of

types of organization, particularly with regard in each case to the power employed.

HAND POWER. The whole of early British industry was carried out by means of hand power, and by reason of its slowness it was not possible to make



A SEVENTEENTH CENTURY HAND LOOM

articles other than those required for food and clothing. The members of early families, when not engaged in work in the fields, or in domestic duties, undertook spinning and weaving. Their methods of working were of the crudest. Spinning they accomplished by means of a simple distaff, the spindle of which was at first held under the arm, but later was kept in position by a support and turned by means of a handwheel. In weaving, the web was in earliest times laid on the ground. The next development was an upright loom with an operator on either side, a method which is still

retained in modern tapestry weaving. The loom was finally arranged so that the weaver could sit at his work, and this latter method was continued until past the middle of the eighteenth century.

The next stage was marked by the introduction of the treadle to the distaff and loom, so that both hands of the worker were free to attend to the material. No change, however, took place in the source of power, as human effort was used in both cases.

Agriculture is always the first occupation of a growing civilization, since food is the prime necessary of life. Hence the early Britons were chiefly concerned in tilling the fields and tending their herds. But corn must be milled into flour before bread can be made, and hand labour was again required in order to effect this change. Two flat round stones, placed one on top of the other, constituted the early type of flour mill. By the turning of the top stone by hand, the full corn was broken and fine flour gradually produced. Flour milling of this primitive character was arduous work and much heavier than spinning and weaving. It is not surprising, therefore, to find that horses became generally used for turning the flour mill. A narrow circular stone pavement was constructed, at the centre of which the crude flour mill was set, and a regular motion was obtained by horses harnessed to a radial shaft.

The need for storing and preserving food created a want which was satisfied by calling into existence the art of pottery. In earliest times animal skins were made into containing vessels. These were later superseded by more convenient and permanent utensils. That wonderful contrivance, the potter's wheel, known to the ancient Egyptians, and still used, was probably introduced into England at the time of the Roman invasion. At first it was a hand machine, which was followed by a variety provided with a treadle for foot operation.

WATER AND WIND POWER. The power contained in hill torrents and running streams can be turned to useful account through the medium of a water wheel which can be attached to a mill to form what is described as a water-mill. It is believed that the Teutonic tribes, who overran these islands during the fifth century, introduced the water-mill, but it would appear that not until the eighth century did they become numerous. Before the Norman Conquest, however, the land was freely dotted with them. The chief use of the water-mills was for grinding corn, as spinning and weaving continued to be done by hand for many centuries.

Water-mills were of three types, the Norse, Greek and Roman. The first two were suitable on small streams, but for regular river courses the Roman type was used. It is interesting to note that the construction of the wheels and the motion of the water-mills of the eighteenth century differed very little from the Roman plan.

As the use of water power became common the manufacturing population gathered along the banks of river courses. Evidences of this are to be found in many parts of the country to-day, and the traveller meets many ruins of water-mills on the hillsides and small river valleys in Scotland, and Lancashire and Yorkshire.

The introduction of windmills was later than the application of water-mills. In England they have been almost exclusively used for flour-milling. Irregularity of working is their main disadvantage, although in early times when no source of power supply was unfailing—for streams are subject to drought—windmills were uniformly distributed throughout the country.

MECHANICAL POWER. *Steam Power.* Probably no one factor has more profoundly affected the course and character of industry than the introduction of

steam power. It is usual to refer to the period of English history ushered in by this remarkable invention as "The Industrial Revolution," and although this term refers to a period in our country's history characterized by a long series of epoch-making inventions, the most important of these—indeed the one which made many of the others possible—was the invention of the steam engine. The name of James Watt is inseparably associated with the steam engine, and to him the credit is due of having so perfected a crude engine as to make it applicable to every variety of the multiform industrial processes which sprang up during the nineteenth century. The steam engine was known before the time of Watt, but its construction was clumsy, its working uncertain, and its performance inefficient.

The existence of steam was known to the Greeks, but was applied only to a toy. During the seventeenth century French and Italian physicists considerably advanced our knowledge of steam. It is the Englishman, Thomas Savery, however, to whom is usually accorded the merit of constructing the first working steam engine. Living near the tin mines in Cornwall, where horses were used to pump water from the mines, he devised a more efficient method, producing by a series of boilers, condensing vessels and tubes, a fairly trustworthy engine, several of which were erected at the tin mines. He compared the performance of his engine with that of the horses, which his apparatus replaced, and in this way introduced the term "horse-power."

Thomas Newcomen, in 1705, made a substantial advance on the invention of Savery. Newcomen obtained a sudden vacuum by the condensation of steam, but instead of employing a closed vessel, as in Savery's engine, he used a cylinder fitted with a piston. Newcomen engines were generally adopted throughout

the colliery districts for pumping purposes. In the operation of the Newcomen engine the cylinder alternated between being very hot and then becoming cold, as in the first place steam entered the cylinder and was then condensed by means of a spray of cold water. This was a very inefficient method of working, and enormous quantities of coal were required to provide enough steam to keep the engine working. In fact, in the Cornish mines, where the carriage of coal was very expensive, the Newcomen pumping engines had to be abandoned.

James Watt conceived the idea of separating the hot engine from the cold condenser, and therein lies his epoch-making invention. Watt spent a considerable part of his life in adding improvements to his original model, and finally produced an engine that was trustworthy and economical and could be adapted to suit practically every requirement of industry.

The steam engine helped to unlock the vast coal and iron resources of the Kingdom, for the hitherto ineffective pumping devices had prevented miners from going very far beneath the surface of the ground. The triple power of coal, iron and steam marks the beginning of a new industrial age, through the first phase of which we have now passed.

During recent years another type of steam engine has been developed to a high degree of perfection. Sir Charles Parsons solved the problem of how to use the power contained in steam to turn a shaft by means of a direct rotative motion, instead of through the medium of a reciprocating motion, as in the case of the Watt engine. His plan was for the steam to impinge against a series of blades arranged around the periphery of a wheel that was free to move about its centre. The force of the steam acting on the blades caused the wheel to rotate and so do work. In practice a number of such wheels fixed on the same spindle

are employed, and between each pair of wheels a set of blades is inserted and fixed in position by being rigidly attached to a casing surrounding the whole. The steam entering one end of the engine is directed on to and strikes a set of moving blades; it is deflected on to a series of fixed blades, and passing over these, is redirected on to another series of moving blades, and so on until it passes the last wheel. A rotary motion is thus given to the shaft carrying the moving wheels. This engine is the steam turbine.

This is a very efficient type of engine; it revolves at a high speed and can be made in large power units, turbines of 10,000 h.p. to 40,000 h.p. being built to-day.

GAS POWER. It is well known that the action of a gun depends on the energy produced when the powder or charge is ignited, whereby a large quantity of gas at a very high pressure is evolved and expels the projectile. A similar action, although not so intense, could be produced by exploding a charge of coal-gas and air. This principle underlies a type of engine known as the internal combustion engine, in which the cylinder takes the part of the gun barrel and the piston replaces the projectile. Lenoir, in 1860, produced the first really practical gas engine, but this was quickly followed by an improved type of engine invented by Dr. Otto, in 1876. This engine performs its cycle of operations during four strokes of the piston. At first, during the outward suction stroke of the piston, a mixture of gas and air is drawn into the cylinder; the piston then returns and compresses the mixture and at the end of the compression stroke an explosion takes place, forcing the piston down the cylinder on its third stroke of the cycle; during the fourth stroke the piston returns and drives the products of combustion out of the cylinder, and the completed cycle is then repeated.

As gas for use in gas engines can now be cheaply produced even in small quantities, this type of prime

mover has become a keen rival of the steam turbine in sizes up to 1,000 h.p. The apparatus in which the gas is generated is known as a "gas producer," and consists of a vertical cylindrical shell of steel in which low grade fuel is slowly burnt, a current of steam being injected into the red-hot furnace. The resulting product of combustion is a gas suitable for use in gas engines.

An interesting type of internal combustion engine was introduced in 1895 by R. Diesel. Crude oil is used as fuel and this is sprayed into the cylinder at very high pressure, resulting in the heating of the oil to a temperature at which it explodes.

ELECTRIC POWER. At the beginning of the nineteenth century scarcely anything was known of the properties of electricity; at the beginning of the twentieth century its character was well known, its possibilities realized, and its power applied to accomplish a multitude of useful purposes. The early years of the present century have witnessed enormous strides in the development of electricity, and future reforms, as regards both fuel economy and more hygienic conditions in home and factory, will in no small measure be effected through the extended use of electrical appliances.

The real beginnings of the generation of electricity date from the time of Michael Faraday, who discovered in 1831 that the movement of a magnet near a coil of metal wire induces electric currents in the wire. He perceived the possibility of generating electricity on this principle by means of a dynamo. Practical difficulties, however, prevented the production of a trustworthy machine, but when the stimulus of a demand for cheap electricity for lighting and traction was felt, great progress was made. Improvements in the design and electrical output of dynamos followed rapidly in the seventies, and by 1881 the first public

electric station was built. During the next three years several electric traction schemes and tramways were developed. The introduction of the carbon filament lamp in 1878 by Edison, Swan and others, marks the beginning of the application of electricity to domestic lighting, and with the development of the metal filament lamp, electric power became extensively used for lighting purposes. But transport and illumination were only two of three well-defined spheres of application of electricity; the other was its use as a source of power for driving the machinery in factories and its adoption to meet all industrial power requirements.

To-day electric power is used in all branches of human activity, in driving factory machinery, in traction, lighting, heating, cooking, ventilating, and even in stimulating the growth of crops. Electric generators are manufactured in very large units, the larger sizes being driven by steam turbines. Our large municipalities are installing in their power stations generators of over 30,000 h.p.

OTHER SOURCES OF POWER. It is interesting to note in passing that attempts have been made to use directly the energy in the sun's heat. A commercial plant is in operation in Egypt, in which steam is generated in a boiler placed at the focus of a series of large reflectors. In this connection it is worthy of note that it has been recently proposed to use atomic energy as a source of power.

Similarly, numerous projects for utilizing tidal energy have been discussed, all embodying the principle of storing water at high tide and working turbines during the release of this water.

THE ORGANIZATION OF INDUSTRY

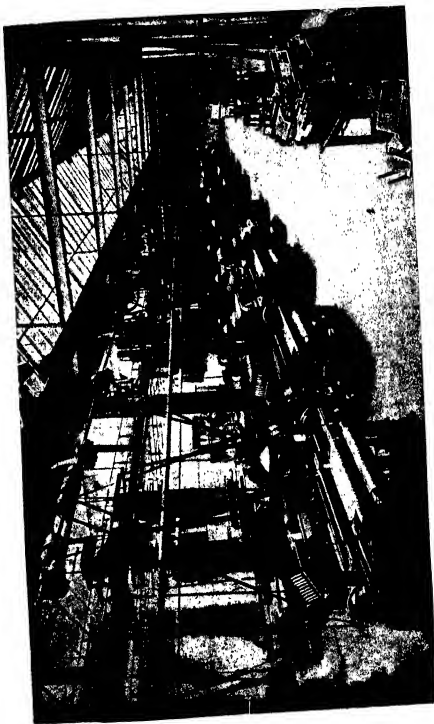
Contemporary with the development of machinery and power processes, changes have taken place in the

character of industrial organization. In tracing the various phases through which British industry has passed, four distinctive forms of industrial organization can be traced. They are, respectively, Family System, Guild System, Domestic System and Factory System.

It is difficult to define chronologically the beginning and the end of any one system, but each type of organization was a natural outgrowth of the preceding form, produced as a result of the changing external conditions, of new discoveries of natural resources and an extended knowledge of their application. The discovery of new forms of power frequently brought about a change in industrial organization, and, as will be seen later, the Factory System was in a large measure due to this one cause.

THE FAMILY SYSTEM. In its earliest stages English economic organization was chiefly agricultural. The country was organized into small communities, each one of which supported itself practically solely upon the results of its efforts in tilling the soil and tending the herds. This Family System scarcely has reference to a form of industrial organization: it refers to the simple domestic arts that were carried on in the homes of the early English people. The only industry of any account was the working of tin and lead which made early England valuable in the eyes of Continental marauders. The fact that England at this period exported only tin, lead, corn and wool—all raw products—is an indication of the absence of any form of organized manufactures. Members of monastic institutions, apart from writing, spent considerable time in producing works in gold and silver, which numbered among the country's exports of that day.

The Domesday Book shows that the country's population at the time of the Norman Conquest was two millions, and of this number, three-quarters lived



A MODERN POWER LOOM
Contrasting with early methods as shown on page 12

by agricultural labour, the remainder being either occupied in ecclesiastical duties or in trading in the exported goods already enumerated.

THE GUILD SYSTEM. As agricultural activity developed, an improved standard of living became common. Simple industries, at first confined to the production of food and clothing, became established in the small villages, and the obvious advantages of division of labour among members of these communities were early realized, so that the miller, the smith, the farmer, the weaver, became important and well-defined members of the community.

As the villages gradually grew into small towns, those workers who plied one trade lived together in one part of the town, attended the same Church, and took part in the same Church Pageants, which marked the beginning of Mystery Plays. It is at once apparent that tradesmen living together under these conditions would soon become fused into bodies with strong common interests.

There was a further influence at work in producing a united organization, which arose by reason of the division of the community into two parts. One part, the craftsmen, supplied the needs of the other part, the consumers, who belonged themselves in many cases to other crafts. The consuming public were protected from fraudulent workmanship by the condition that the local municipal authorities required each trade to elect from among themselves representatives or "Overseers," who would accept responsibility for the workmanship and good behaviour of their fellow craftsmen.

By reason of these two influences these early combinations of craftsmen, known as craft guilds, became exceptionally strong organizations. It can be assumed that the craft guild marks the beginnings of industrial organizations.

It is interesting to note that an underlying principle

of the craft guilds was the idea that a member should work not only for his own personal advantage but in order to maintain the good reputation of his trade and to protect the purchasing public. For example, prohibition against night-work was not designed with the object of protecting the worker from the undesirable physical consequences to himself of such work, but rather in order to avoid defective workmanship, to give daylight for better inspection, and to avoid the noise—regarded as a public nuisance—caused by night-work.

Adequate provision was made for the training of youths and young workers in the practice of each craft, and the personnel of the craft guilds was divided into apprentices, journeymen and masters. These divisions were stages of development, and it was assumed that the apprentice successfully completing his training would become a journeyman and finally mature into the full estate of master. In many cases the workshop was attached to the house of the master around whom the journeyman apprentices lived as a family, enjoying the peculiar privileges of such a relation and sharing in the common family life.

THE DOMESTIC SYSTEM. The Guild System flourished in the fourteenth and fifteenth centuries, but during the two succeeding centuries factors arose which tended to destroy the characteristics of the guild and to substitute by a slow process of evolution another type of industrial organization. It is noteworthy that the woollen industry, which was the first to assume the guild form, was also the first to depart from it. Considerations of economy showed that it was much better to rear sheep under the most favourable conditions, and at the same time to carry out manufactures also under the most favourable conditions, the place of manufacture being on this account frequently removed from the place of production of raw materials.

At the same time, most manufacturers were subject to numerous municipal and guild restrictions while they remained in the towns and they frequently organized small groups of people for industrial purposes in country places where they were free from all rules and regulations. This afforded greater opportunity for the division of labour and helped to produce the gradual movement of the manufacturing population from the towns to the villages and country sides. This migration of labour was a marked feature of the Domestic System of industrial organization.

Since the source of supply of raw materials was now removed from the place of manufacture, the necessity arose for a new class of person whose function was to act as a link between the workers and their homes on the one hand, and the source of supply of raw material and place of disposal of the finished product on the other.

In this way there developed the office of "entrepreneur" or middleman. Under this new system of industrial organization, the community may be considered as comprising a three-fold division. There were the workmen still in possession of their own instruments of manufacture; and middlemen who invariably were without capital; and the general body of the public who were the consumers.

During the seventeenth and eighteenth centuries the centre of gravity of the industrial system moved from the workman to the middleman; the former, while still continuing to possess their own instruments of manufacture relied more and more upon the middleman, not only to provide the raw materials and to find a market for the finished goods, but also to obtain the necessary capital with which to purchase other goods and to accept the risk involved in organizing the industry. In fact it can be assumed that during the early part of the eighteenth century industry was solely dependent upon the capitalist-middlemen, and

the workers in their own homes were completely out of touch with the markets and virtually worked for the middlemen as piecework employees.

In many parts of industrial England are still to be found the remains of the days of the Domestic System of organization. The flagged paths that are so frequently met with in the country districts of Lancashire and Yorkshire running along the side of hedges, and walls, and across fields, bear witness in the well-worn appearance of their rough stone blocks, to the days when raw material was carried to the workers' homes and the finished goods taken to the markets in packs slung across the backs of middlemen and their assistants. Even merchandise that was carried a long distance was packed into sacks and sent on pack-horses, long lines of which could frequently be seen travelling in single-file along the narrow tracks that joined the principal towns and led to the coast.

THE FACTORY SYSTEM. The final stages of the Domestic System of organization produced an itinerant middleman delivering raw material to, and collecting finished goods from, the homes of his workpeople. The next step was a short and obvious one. These middlemen set up small factories, equipped them with machines, and invited the hitherto domestic workers to tend the machines in such a factory. In the first place, the looms were driven by water power, and we have already noted in an earlier part of this chapter that many ruins of water-mills are to be found in lonely valleys in Scotland and the North of England. The discovery of iron and steel brought in its wake, during the years 1760 to 1780, the invention of cotton spinning machines, and Watt's steam engine, all substantially assisting the change that had already commenced. Factories sprang up in all parts of the industrial world, the Domestic System passed and gave place to the **Factory System.**

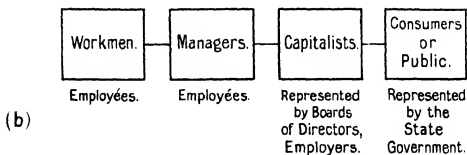
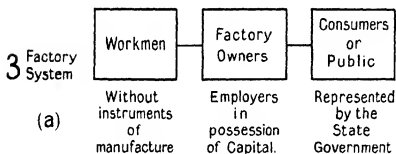
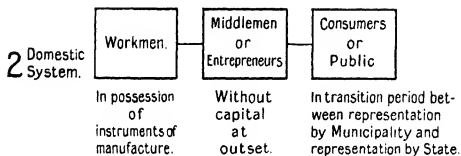
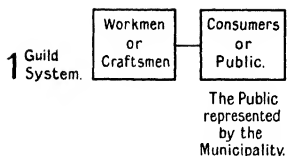


FIG. 1.—THE EVOLUTION OF INDUSTRIAL ORGANIZATION

A new source of wealth was discovered, and its immediate possibilities became so substantial as to attract considerable attention, and statesmen were not slow to appreciate the part that industry was to play in promoting the welfare of the world. The new instruments of production were largely in an experimental stage, and people interested in industry focused their attention on improving the crude forms of machinery, so that this period, known as the Industrial Revolution, tended to assume a one-sided development and the well-being of men and women in industry was overlooked. The years following after Waterloo were marked by extreme poverty among the working classes, and it is somewhat unfortunate that the Napoleonic War, with its train of penury should have been waged at the time when the introduction of a new type of industrial organization took place, because the direct results of the one are apt to be confused with the results of the other.

During recent years the Factory System of industrial organization has passed through many changes, and presents to-day a very complex picture.

CHAPTER III

MODERN TYPES OF PRODUCTIVE ENTERPRISES

INDUSTRY is the result of the operation of a variety of factors. There must be human effort, which may take the form of either manual skill or organizing ability, or more usually a combination of these. A certain amount of capital is required, either in the form of equipment and machinery or in the more common form of money, which later is wanted to purchase, among other things, materials and machinery, and pay wages. Finally, natural forces and resources are essential to supply power and raw materials. All these factors are present in modern industry, but the manner in which they may be organized so as to produce an efficient industrial concern admits of great variation. Such organization may be described as industrial government, and it is proposed in this chapter to examine the fundamental features of its more important types.

PRIVATE BUSINESSES AND PARTNERSHIPS

Most businesses require some capital, and an individual who can secure the requisite amount of capital may establish a private business, such as a retail stores or shop, a works, or office.

Economically there is much to be said for this type of organization. Responsibility for success is located in one, or a very few persons, who are continuously incited by self-interest to efficiency. In the long run, of all those who start in business for themselves, only those with a capacity for efficient service survive, and from an economic point of view, this is a desirable

result. A man who so launches into business throws all his personal property into the venture.

When two or more persons conduct business in common with a view to profit, the relation existing between them is known as a "Partnership." Technically it has no reference to the limited liability company, which will be considered later. A partnership is known as a "firm," to distinguish it from a "company." A partnership may be regarded as an enlarged form of individual business, and similar economic arguments can be advanced in its favour.

COMPANIES

A great number of businesses require amounts of capital so large as to make it impossible to establish them on private lines. In such cases companies are formed, known as limited liability companies, in which shareholders subscribe the capital and are a body separate and distinct from the directors and other officials who actually conduct the business. Directors are appointed by the shareholders, and the former appoint other officials to manage the business in lower executive positions. At the same time the liability of shareholders in respect of business debts is limited to the extent of the capital they have invested; shares also are transferable.

The conduct of this type of enterprise is closely regulated by public law comprised in the various Companies Acts. It is not now lawful for any company, association or partnership, consisting of more than twenty persons (ten in the case of banking) to trade for gain, without registering as a company under the Companies Acts, with the Registrar of Joint Stock Companies, Somerset House, London.

There are two main classes of companies, known respectively as Joint Stock Companies and Public Companies. The former are constituted under the

Companies (Consolidation) Act, 1908, and amending Acts, and the latter under a special Act to carry on work of public utility, such as railways, docks, gas or water works, and they are regulated by the Companies Clauses Acts, 1845 to 1863.

Joint Stock Companies also admit of a two-fold division. On the one hand, there are companies restricted to a limited number of shareholders, who are often members of a family or other associates. While such companies have to comply in every way with the requirements of the Companies Acts, shares never reach the open market, and the public, therefore, never have an opportunity of becoming shareholders. On the other hand, there are companies, the great majority, which are supplied with capital subscribed in the open market and in which the public have the opportunity of becoming shareholders.

In the formation and organization of a company a number of documents must be drawn up. The first of these is the Memorandum of Association, which must be supplied to the Registrar, and is required to state five things, namely—

(1) The name of the proposed company, with the addition of the word "Limited."

(2) The part of the United Kingdom in which the registered office of the company is proposed to be situated.

(3) The objects for which the proposed company is to be established.

(4) A declaration that the liability of the members is limited.

(5) The amount of capital with which the company proposes to be registered, divided into shares of a certain fixed amount.

The second document to be prepared is that described as the "Articles of Association." This outlines the rules and regulations for the internal management

of the concern. A specimen set of Articles of Association is appended as Table A to the Companies Act, 1908.

A third document, known as a Prospectus, is an invitation to the public to take shares in the company, and constitutes the basis of the agreement to take the shares.

Detail procedure relating to the keeping of proper records, such as register of members, transfers, etc., is included among the duties of the secretary, who is the official held legally responsible for this work.

The capital of the company, while divided into a number of shares of fixed amount, is also frequently grouped in divisions according to the order in which these divisions rank for receiving distribution of profits. The simplest form of division of capital is that in which the whole is divided into ordinary shares, so that the profit is divided among all the shareholders in proportion to the amount of their investment.

The more usual arrangement of capital, however, is that in which there are two main divisions, preference shares and ordinary shares. The holders of preference shares receive a fixed percentage of dividend and participate in profits up to the extent of this fixed percentage before any distribution is made among the holders of ordinary shares. Preference shares may be either cumulative or non-cumulative, and in the former case the preference dividend, if unearned in any year or a term of years, must be paid up in full before the ordinary shareholders receive dividends.

In certain types of companies provision is made in capital arrangement for cumulative participating preference shares. This is a very attractive share whereby the preference holders, after receiving the full preference dividend to which they are entitled, participate further in the profits after a certain fixed dividend has been allocated to the ordinary shareholders.

Among the securities of railway and industrial

companies are debentures and debenture stock, and holders of these securities have the first charge on the income of a company, usually to the point of being able to foreclose the concern and realize its property in order to satisfy the creditor claims of debenture holders.

INDUSTRIAL COMBINATIONS

Industrial combination has been broadly defined as "a method of economic organization by which a common control, of greater or less completeness, is exercised over a number of firms which either have operated hitherto, or could operate independently. This control may be either temporary or permanent, for all or only for some purposes. The motive and, while it lasts, the effect of combination is to create over market conditions an influence for greater, more conscious and more centralized regulation; and this influence varies with the proportion of operating capacity over which control is obtained." It is necessary, therefore, to distinguish between industrial combination and combinations of employers or employed. In the former, the firm or company, complete both in personnel and organization, is considered as the unit, whereas in the latter a section of the company's personnel only is the unit of combination.

In general, industrial combination results from keen competition for markets, aggravated by trade irregularities, which is experienced by firms engaged in the same or similar lines of manufacture. It is felt that some measure of combination can facilitate marketing by either eliminating or reducing competition between members of the group, or enhance the competing strength of the group by aggregations of capital or close regulation of output or prices. Also combination is prompted by a desire to secure greater efficiency in manufacture.

There are two main types of industrial combination, known respectively as Trusts and Cartels. A Trust is an amalgamation of firms, each one of which, to a greater or less extent, loses its individuality and is controlled, usually fairly rigidly, by a central body. A Cartel, on the other hand, is a group of firms operating under a common agreement respecting markets, output and prices. In contrast to the Trust it is a loose combination.

TRUSTS. Trusts appear to be justified if combination results in increased economy, that is, if the combination can be conducted with greater efficiency than can individual firms; but if the motives of combination are non-economic, being either purely aggressive or defensive, or political, a debatable issue arises. The history of the American Trusts provides the most outstanding examples of increased efficiency and greater economy resulting from combination. Professor Macgregor writes: "Out of twenty-four firms which came into the Sugar Trust it was found possible to supply the whole market with only six; while out of eighty firms which came into the Distillers' Trust, it was found that sixty-eight were superfluous. The capacity of the Steel Trust for finished products in 1902 was nearly 60 per cent greater than the greatest actual annual output of finished steel ever reached previously in the United States." Great economies are effected by controlling production, for a works manufacturing one or two types of articles on a basis of mass production can, it is well known, produce much more cheaply than one making a few products of many different types, and there are further advantages of having central sales organizations, thereby preventing waste by one firm advertising against another, and of large scale purchase of raw materials, thereby securing lower buying prices.

Although definite arguments may be advanced in

favour of Trusts in certain cases, there are dangers to be considered and guarded against. The growth of a Trust, necessarily involving an increasing degree of monopoly, may result in the atrophy of individual enterprise and of the competitive spirit, both of which are healthy stimuli to efficiency of production. The struggle for existence, as the monopoly extends, becomes less and less acute, and this may result in the company's leaders and managers relapsing into apathy. The only corrective to this tendency is to ensure that only those men are promoted to leadership within the combine who have demonstrated broad capacity and sound ability for undertaking greater responsibilities.

A further danger lies in the ignoring, on the part of the Trust, of developments in the art in which they are engaged, such, for instance, as follow from scientific discoveries and inventions, and they may even prefer to carry on with obsolete machinery and plant rather than keep abreast of the times and thus give the community the benefit of new knowledge and discoveries.

A great difficulty in the path of a Trust's success is the problem of management. The organization gradually becomes so colossal that only a man of profound organizing powers can control the whole. There is the danger that the evolution of a Trust may be cyclic, rising to a crest of success with the full strength of an industrial genius and falling with his removal.

CARTELS. The Cartel is the European counterpart of the essentially American Trust. Its governing body is composed of representatives of each of the combining firms, and all sales are made and orders received through a central committee or bureau. As it admits of much earlier formation than a Trust, it is also more easily dissolved. Its main advantage lies in market distribution and price regulation.

Arguments both for and against this type of combination are very similar to those already advanced in the case of Trusts.

THE CO-OPERATIVE MOVEMENT

Of a very different character from Companies, Trusts and Cartels, is the co-operative method of industrial government. It is usual to assign the inception of the co-operative movement in this country to the year 1844, when the Rochdale Pioneers opened the first co-operative stores. This store in Toad Lane, Rochdale, was organized by twenty-eight men who each subscribed £1 capital. Interest on the money invested was paid at 5 per cent, and the principle of the scheme was that after this "wages of capital" had been paid additional profit should be divided among the members in proportion to the amount of their purchases, and quite irrespective of the amount of their invested capital.

The members bought from the stores at ordinary market rates. The Rochdale plan was completely successful, and the membership grew steadily. It was not long before similar stores were opened in other parts of the North of England, chiefly in Lancashire and Yorkshire.

The financial stability of the co-operative movement may be attributed to two main reasons. In the first place, while the business of the stores extends into a variety of commodities, these are all common necessities, being either food, clothing or general household goods, for which there is a constant demand unaffected by the uncertain and varying factors such as fashion, etc., which influence other trades. In the second place, the principle of the co-operative movement is such that every new increment of capital brings with it an addition of fresh custom, and thus the danger of

over-capitalization, so common in other types of productive enterprises, is completely avoided.

It should be noted that since its commencement, the co-operative movement has insisted on cash sales, no credit whatsoever being allowed. The moral stimulus on co-operators of such a practice has been very pronounced and has conduced to the formation of habits of thrift.

It would be wrong to give the impression that the early co-operators entered business from motives of profit. They entered business with feelings akin to those of a missionary commencing a journey. The mission of the co-operators was to rescue a world of consumers from individual capitalists who had grown sullen as a result of the working of the capitalist system during the early part of the nineteenth century.

The early co-operative stores were associations of consumers. An Association of Producers was formed in 1863, when the Co-operative Wholesale Society was established. This Society, popularly known as the "C.W.S.," bears precisely the same relation to the co-operative society as the latter does to its individual members. The capital of the Co-operative Wholesale Society is supplied by the societies, and the management elected by them. When the Wholesale society was first established it purchased goods in bulk from English and foreign markets and distributed them for final retail to the co-operative societies. As its business grew it erected factories of its own, so that to-day, while a certain amount of co-operative commodities are bought in the open market, a considerable portion is made in its own factories.

Co-operative propaganda is undertaken by the Co-operative Union, Limited, which is a federation of the chief co-operative societies in Great Britain. Its funds are contributed by the societies, and its functions are of a legal and Parliamentary character.

This organization conducts extensive educational work by means of literature, classes, summer schools, and local conferences.

The educational work of the co-operative movement is important. One of the rules of the Rochdale Pioneers reads as follows : " That as soon as practicable this Society shall proceed to arrange the powers of production, distribution, education and government ; or in other words to establish a self-supporting Colony of united interests or assist other Societies in establishing such Colonies."

The educational value of the co-operative movement was thus early grasped. The most advanced societies have a very complete scheme of classes of instruction embracing a variety of subjects. Special training courses are also provided for co-operative secretaries and salesmen, and juvenile employees and apprentices. A limited number of university scholarships are also provided.

The co-operative movement is essentially democratic in character, its dominant note being self-government. It affords an excellent opportunity for the man of ability to rise to positions of responsibility and gives effect to the principle of promotion of those with capacity. One writer refers to this as follows : " From membership to a seat on the Committee, from the Committee to the Presidency, from the Presidency to a seat on the Board of the Wholesale Federation on the one hand, or on the Central Board of the Co-operative Union on the other, there is a graduated ladder of responsibility which the intelligent working man may climb."

Respecting the contribution which the co-operative movement has made to the solution of the problem of industrial unrest, it will be generally conceded that co-operators are regarded as good employers, and the weekly half holiday now enforced by law was first

voluntarily granted by co-operators. It is, however, a significant fact that co-operative employees have formed a very strong trade union to protect their interests, and the vigorous campaign which the Women's Guild have conducted to secure a minimum wage, shows that there is still room for improvement.

PROFIT SHARING AND CO-PARTNERSHIP

Productive enterprises organized on a basis either of profit sharing or of co-partnership, stand midway between private or public enterprises and pure co-operation. Profit sharing assumes the private enterprise type and introduces modifications: labour co-partnership in its advanced form assumes the co-operative type and introduces modifications.

It is most convenient to define "profit sharing" by using the formula of the International Congress in Profit Sharing held in Paris in 1889, namely: "The International Congress is of opinion that the agreement, freely entered into, by which the employee receives a share, fixed in advance, of the profits, is in harmony with equity and with the essential principles underlying all legislation."

The simplest case of profit sharing is that in which surplus profits are divided among workers after a predetermined rate of interest has been earned by capital. As the scheme becomes more advanced, workers are encouraged to invest their money in the undertaking, ordinary or special shares being allotted after certain conditions are fulfilled. Profit sharing undoubtedly secures the interest of workers in the well-being of the concern, and hence is often of importance in those concerns where the human factor is a matter of first order. In years when profits are small or may be absent altogether, the absence of bonus may cause dissatisfaction among the workers, and is a factor to be reckoned with. On the other hand, the systematic



A WATER WHEEL

Illustrating local application of water power

payment of bonus tends to remove that incentive to effort on the part of the workers, which is usually the whole *raison d'être* of the scheme. The long interval which lapses between the payment of successive bonuses, usually one year, is frequently a further factor in removing this incentive, and in some concerns bonuses are dispersed monthly or quarterly in order to maintain the close interest of workers in the scheme.

Co-partnership, or as it is more usually described, Labour Co-partnership, means more than mere profit sharing: it combines a share of the profits of the concern with a share in its management.

Co-partnership may be defined in terms used by the Labour Co-partnership Association, namely: That the worker shall acquire some share in the control of the business in the two following ways—

(a) By acquiring share capital, and thus gaining the ordinary rights and responsibilities of a shareholder.

(b) By the formation of a Co-partnership Committee of workers having a voice in the internal management.

Co-partnership is much less generally applied than is profit sharing, although in certain trades, chiefly textile, boot and shoe, and printing, very successful works are organized in this manner.

The main difficulty in the path of labour co-partnership is securing a system of training workmen to occupy management positions. It is worthy of note that in the outstanding example of co-partnership on the Continent, one which preceded any English experiment, special care was exercised by the management in selecting and training reliable workmen to serve on the management, and moreover, the change from the ordinary business type of co-partnership was gradual.

It becomes clear that in the case of co-partnership, bonus is distributed among employees in the form of shares, rather than in cash. One objection that has

been raised against this method is the attendant danger of over-capitalization, and in most schemes this danger is recognized and guarded against. In the case of one of the most successful co-partnership enterprises in this country, the South Metropolitan Gas Company, the directors in issuing new stock reserve a certain amount for their employees, but when not issuing new stock, as has been the case for many years past, they buy stock in the open market at current rates and resell at the same market rate to their work-people. Over-capitalization is by this means avoided.

Respecting the life of these types of productive enterprises, it is interesting to quote from the Ministry of Labour's Report on Profit Sharing and Labour Co-partnership in the United Kingdom (1920).

"The most noticeable feature in the statistics of the Profit Sharing and Co-partnership movement in this country as a whole is the large proportion of schemes which have ceased to exist. Out of 380 schemes which are known to have existed at some time or another, no fewer than 198 have come to an end. Only 14 of the schemes now existing are of more than thirty years' standing, and only 36 were started earlier than the year 1910."

MUNICIPAL OWNERSHIP

There are certain commodities and services, such as water, gas, electricity and tramways, that are most conveniently supplied through public local control.

The municipality owns and manages the business, so that in the long run its policy can be assumed to be determined by the general body of electors. At the beginning of the present century, 299 out of a total of 317 corporations were conducting business undertakings of the type under consideration, and a total capital of upwards of £120,000,000 was involved.

An examination of the factors influencing municipal

ownership shows that certain general conditions are fulfilled. In the first place there is a marked tendency to unify the supply of the particular commodity or service. For example, the capital expenditure involved in laying down an electricity distribution scheme is so great compared with annual revenue that rival companies would have little likelihood of survival. In the second place the type of undertaking that is municipally owned is such as usually to require sanction for certain rights from a public authority, as the right of way for gas or water pipes, and electricity conductors, or the right to use the public streets in the case of tramways. This fact, together with the need, irrespective of the type of ownership, of some measure of public control or regulation, makes it a small step to complete ownership by the public authority. Finally, the demand for the goods and services locally owned, is usually purely a local one, and it appears reasonable that its administration should be local. Furthermore, such industries can be regarded as "key" industries for the locality, in the sense that they are essential for the life and welfare of the civic and industrial community.

The obvious criticism of municipal ownership is that businesses organized on this basis are much less efficient than those conducted on more commercial lines, the cumbersomeness of democratic methods being notorious. As against this, however, public criticism is usually very potent, and the local press can readily bring to light deficiencies in administration.

OTHER FORMS OF INDUSTRIAL GOVERNMENT

Under the general title of Socialism various forms of industrial government have been advanced, all of which start from a common basis, namely, the abolition of the private ownership of the means of production and distribution. The declared object of the socialist

party is "To end the present capitalistic system together with all forms of hereditary and economic privilege, and to establish a system by which a community will own, organize and control its resources for the benefit of all." The two most important forms of socialist industrial government are Nationalization and Guild Socialism.

NATIONALIZATION. Nationalization means the transfer from private to communal ownership of any or all of the means of production or distribution. "There are various ways in which an industry can be nationalized by Act of Parliament. It may be simply taken over without compensation—i.e. the shareholders may be expropriated; or it may be bought from the shareholders—at the market price (the price which, as an ordinary business transaction, a group of private individuals would be prepared to pay for it), at less than the market price, or possibly (if the shareholders are members of, or have influence with, the Government) at more than the market price. If it is intended to buy the industry it is improbable that the Exchequer will have sufficient money available to pay for it outright; in which event the plan most usually proposed is for the Exchequer to borrow money from the shareholders themselves—i.e. to hand over to the old shareholders Government stock, paying a certain fixed rate of interest. But it is obvious that if this interest is to be paid in perpetuity to the original shareholders, their heirs, or the persons to whom they may transfer the stock, then the position, from the Socialist standpoint, will be most unsatisfactory; for, although we shall have got rid of production for private profit, a great army of people will be drawing a share of the wealth produced by the community, not because they are themselves contributing anything towards the production of it, but because they, their ancestors,

or their friends, once owned the *means* of production. How then can the debt be cleared off? It can be repudiated at some time or another—the Government stock can be cancelled, for instance, at the death of the holder; or alternatively a sinking fund may be set up by means of which, with greater or less speed, the capital may actually be paid back. What the latter method comes to is this: the community pays a great share of its wealth to non-workers¹ for a generation, in order that in the next generation it need pay them nothing.

“The State Socialists in England have not as a body contemplated simple expropriation; but between the methods of sinking fund, repudiation at death, and other devices, they have been divided. Few have regarded a perpetual debt charge as a possibility.”²

GUILD SOCIALISM. “The Guild Socialist desires to see every industry democratically conducted by a self-governing body consisting of all the workers in that industry, organized into a profession which they may carry on in the public interest. Mine-owners will not, as at present, buy for a wage, absolute control over the labour of the individual miner, who has no voice in the management of the industry and no control over the product; nor will there be a State mining department, which similarly will hire miners for a wage who similarly will be voiceless; but a single National Guild of all mine workers—manual, technical, intellectual—will conduct the industry on self-governing lines, appointing and dismissing managers from among their number, and so bringing real liberty and real democracy into the work which constitutes so important a part of their lives.”³

¹ Or rather, to certain citizens *quo non-workers*; it may, of course, in addition pay a salary to the same citizens *qua workers*.

² Extract from *Industrial Ideals*, by Victor Gollancz, pp. 23-24.

³ Extract from *Industrial Ideals*, by Victor Gollancz, pp. 23-24.

CHAPTER IV

FACTORY LOCATION AND DESIGN

THE buildings in which manufacturing processes are carried out are known by the various names of Works, Factories, Mills, Refineries, and so on, but by whatever names they are known the reasons for their establishment and the principles underlying their organization are very similar. In this book the term "Factory" will be used throughout, although it must be clearly understood that this term is intended to comprise all similar organizations, many of which bear other names.

In establishing a factory, two main considerations arise, namely, the selection of a suitable site and the design of the building. The numerous other considerations that arise will be noticed in the following brief analysis of these two major problems.

LOCATION OF A FACTORY

The geographical situation of a factory exercises a marked influence on its efficiency, its effect being more pronounced in the case of a small than a large concern. The small concern relies on numerous outside industries for many of its supplies, its markets are usually local, and its managerial staff and capital are drawn from a restricted area. The large concern, on the other hand, is to a much greater degree self-supporting, for, given raw material, it produces for itself all component parts and semi-finished products. Its size secures publicity, so that labour and capital are attracted to it from a wide area.

In determining the location of a factory the most important factors are proximity to raw materials and markets, transport conditions, power supply, supply

of labour, cost of land and climatic conditions, although in any given industry other special points will frequently have to be taken into account.

The effect of nearness of raw materials to the manufacturing centre can only be measured properly by cost analysis. This involves more than a comparison, for different locations, of costs of raw materials per unit quantity even when delivered at the factory so as to include transport charges. Costly manufacturing processes may have to be undertaken or exceptionally large reserve stocks carried merely to compensate for deficiencies in quality or type of raw materials—deficiencies that could have been eliminated had the factory been located near more suitable sources of supply. Hence the ultimate criterion is the cost of material per unit of completed product.

The problem of transport is important, for apart from the obvious effect of its cost, it has a special significance in establishing regular supplies, and in the case of perishable materials, in determining their condition. For many types of products road transport to-day is as cheap and efficient as rail, and secures the distinct advantages of minimum handling and quick delivery. It is steadily gaining in favour, and may ultimately become one of the most important branches of transport. Transport by coast and river steamers will always be commercially applicable to certain kinds of heavy and durable materials where rapid delivery is of secondary importance: canals have at present only a limited application, and among other things are used for the carriage in limited quantities of coal, stone, etc.

Factories usually require an unfailing supply of coal for power purposes, for even where gas power is used it is generally produced on the premises from low grade fuel. Apart from that required for power purposes, coal is used also for raising steam in

connection with various manufacturing processes. The advantage of nearness to a source of coal supply is thus marked.

Certain continuous process industries, such as paper-making and flour-milling, in which water-power has distinct advantages, and for certain mills, as for instance, pulp mills, which must be placed near to forest clearings, water power is essential owing to the heavy charges of coal transport. As noted earlier, electric power is being increasingly adopted for industrial purposes, and this type of power either is generated within the factory in a small generating station, or is brought in bulk from a local electric supply undertaking. Nearness to such an undertaking offers distinct advantages to a small or medium sized factory, or to one with a fluctuating load, for electric power is available at rates varying according to quantity used, and the factory saves capital by avoiding the necessity for establishing its own power plant.

The success of a factory depends in no small measure on being situated near to a source of supply of industrial workers. Should the erection of a gigantic industrial concern be contemplated, this consideration would not be so important, as workpeople would migrate from the towns to the new centre of employment round which a small township would rapidly grow. Several of the national shell factories and arsenals that were erected during the war provided examples of this migration of labour. Clearly the housing question is closely involved in the question of labour supply, hence it is that large manufacturers have taken keen interest in the housing problem and in several cases have erected dwellings for their workpeople.

Cost of land may materially influence a choice of factory site, as it is important that factories should be located so as to adjoin open land suitable for extensions

or storage, or, in certain industries for refuse dumping. Provided all other conditions are suitable and the character of manufacture permits, a high cost of land may force a manufacturer to erect a multiple-story building on a restricted ground area, rather than a number of single-story buildings. In any case, it should be borne in mind that it is usually cheaper and more efficient to extend existing buildings than to build additional factories in remote areas.

The broad geographical location of a factory is frequently determined by other conditions. Climatic conditions, for instance, settle broadly the location of the cotton industry which, it is well known, can only be carried on efficiently in places where the atmosphere is normally humid, as in Lancashire. Then again, in consequence of certain advantages accruing from the aggregation into one area of the factories of a particular industry, a number of industries have become associated with definite localities. The Sheffield cutlery trade, the Lancashire cotton trade, the Leicester hosiery trade and the Northampton boot and shoe trade are cases in point. Buyers apply to the centre of the trade and thus spare the manufacturer the trouble of seeking his market. As the industry develops and individual manufacturers build up a good reputation, the locality gradually acquires a fame that is shared equally by all in the district. Such advantages as these naturally determine broadly for an intending manufacturer the location of his factory.

FACTORY DESIGN

The design of a building in which manufacture is conducted in no small measure affects cost of production, and has a marked influence on the general health and welfare of the workpeople. A variety of factors

influence the character of design, and the more important of these are considered below.

CHARACTER OF THE MANUFACTURE. Manufacturing processes may be classified into three main groups, according to the character, which may be simple, analytic or synthetic.

- *The simple sequence* of manufacturing processes is diagrammatically illustrated in Fig. 2 and indicates the raw material, Stage 1, passing through a series of consecutive processes of manufacture and finally reaching Stage 5, which represents the complete product in so far as the particular factory under consideration is concerned. This simple sequence can be most easily illustrated by reference to the manufacturing processes of a paper mill.

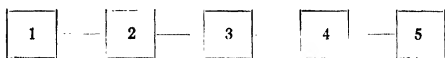


FIG. 2

The raw material, which consists of rags of various qualities, is sorted by women who stand in front of a platform. The rag is cut up into small pieces about four inches square, which are then placed inside a metal cylinder which is revolved at a very high speed, so that all the dust in the cloth is shaken out. The rags are next boiled in water impregnated with soda, in order to remove the grease and dirt, and passed to the next manufacturing stage in which they are placed in a "beating machine." It consists of a heavy roller mounted with blunt knives revolving on an iron plate contained in a trough of water. The rags passing between the knives and the plate have their fibres torn asunder, and during this process the fibre is continuously washed. A fine cloth pulp is turned out from the machine, and after being bleached in a bleaching vat, it passes on to the paper-making machine. The pulp runs on to a moving belt

consisting of brass wire cloth with very small meshes, and as it passes along, the water is pressed out and the fibres are knitted together. Finally, the remaining moisture is extracted by powerful suction pumps. During this process the pulp is subjected to great pressure, and finally emerges from the machine as white paper. The next processes are drying and calendering, whereby the paper is thoroughly dried and a glossy surface imparted, and after cutting and packing it reaches its final form.

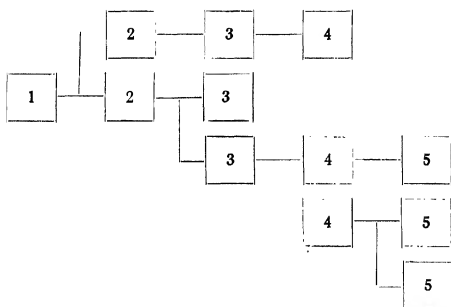


FIG. 3

The analytic sequence of manufacturing processes is diagrammatically illustrated in Fig. 3, and refers to the case in which a complex raw material is broken up, during the course of manufacture, into a large number of separate commercial products.

As illustrative of the analytic sequence of manufacture the gas industry may be quoted, in which the complex raw material, coal, is subjected to a series of operations, producing component parts, such as gas, tar, aniline dyes, benzol, carbolic acid, all having a commercial value.

The synthetic sequence of manufacturing relates to

industry in which a number of raw materials are used in the manufacture of parts which may individually run through longer or shorter simple sequences of manufacturing processes, to be then grouped into minor assemblies, which finally take their place in the complex product. The synthetic sequence is diagrammatically illustrated below, in Fig. 4.

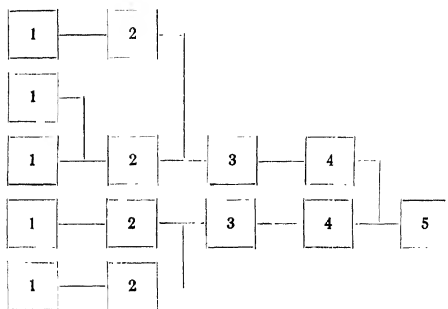


FIG. 4

The manufacture of an electric motor illustrates this sequence. The motor consists of two main parts, a stationary outside part and a revolving interior, and the finished product is gradually built up of a large number of component parts which are made first into minor assemblies, and then into the completed products. In these processes many different materials are used.

TYPES OF BUILDINGS. Factory buildings may be grouped into three main classes, namely—

- (a) Single-story buildings with roof lighting.
- (b) Single-story buildings with long span roof trusses and overhead travelling cranes.
- (c) Multi-story buildings.

In general, multi-story buildings are erected where

the manufacture is not of too heavy a character or where the cost of land is high or area restricted. The least cost per sq. ft. of floor space results from the adoption of three and four-story buildings. With the addition of stories above the fourth, the cost per sq. ft. of ground floor increases rapidly, by reason of the necessity for better ventilation, more rigid structures and more liberal allowances for staircases, lifts, and fire escapes. From the point of view of heating and ventilating, multi-story buildings have distinct advantages.

It is sometimes usual to classify buildings according to the materials used in their construction. Four main types of construction are available; wood building; buildings of brick walls and heavy wood framing; steel frame buildings with curtain walls of brick and floors of wood; reinforced concrete buildings with buried wires and rods.

The following table shows comparative costs of buildings constructed of different materials, assuming a standard of 100 per cent to represent the cost of a building with brick walls, structural steel framing and fireproof floors.

COMPARATIVE COSTS OF BUILDINGS CONSTRUCTED OF DIFFERENT MATERIALS.

(1) Timber frame buildings (non-fireproof)	85%
(2) Buildings with brick walls and timber floors	88%
(3) Buildings with brick walls and fireproof floors	106%
(4) Buildings with stone walls and timber floors	98%
(5) Buildings with stone walls and fireproof floors	116%
(6) Buildings with brick walls, exposed structural steel framing, and fireproof floors	95%
(7) Buildings with brick walls, encased structural steel framing, and fireproof floors	100%
(8) Buildings with brick walls and structural reinforced concrete framing and floors	87%

LIGHTING, HEATING AND VENTILATING. Good lighting is a first essential of a factory building, and by the ample provision of large windows in the walls with roof lighting wherever feasible, as much natural daylight as possible should be allowed to enter. Equally important is the design of artificial lighting, as defective lighting not merely has injurious effects on the health of workers but is a contributory cause of bad workmanship.

While each factory will require certain special lighting provisions to meet the requirements of the specific type of manufacture, certain general conditions can be enumerated which should be satisfied by every system of works artificial lighting. They are—

“(1) Sufficient general illumination should be provided to enable the workers to find their way about the building with safety, and to avoid obstacles, running machinery, etc.

(2) Sufficient light should be provided at the point of work to enable the operations to be carried out with ease and comfort.

(3) There should be uniformity of illumination over the whole surface worked upon.

(4) Glare and undue contrast between the illumination at the point of work and the surroundings should be avoided.

(5) Inconvenient shadows, whether cast by neighbouring obstructions or by the workers themselves, should be eliminated.

(6) The lighting should be especially adapted to the character of work done.”¹

The air in the factory needs to be kept at a uniform temperature and sufficiently high to ensure the comfort of workers. Factory atmosphere should have a winter temperature of between 60° and 70°F. There are three commonly used heating systems—forced

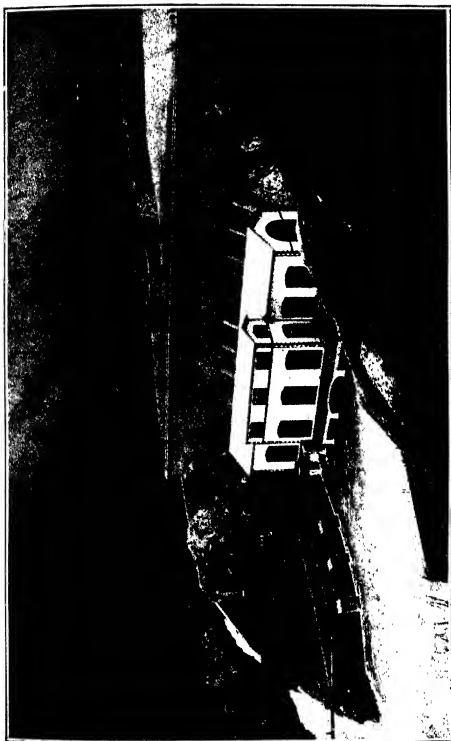
¹ *Industrial Buildings*, by Moritz Kahn.

air system, steam heating system, and hot water system. For all except the smallest factories the hot water radiator system is totally inadequate. The most desirable system is that in which heating and ventilating are provided for in one scheme, and usually consists of a large intake pipe for fresh air, a power driven fan, a number of pipe coils for heating or cooling purposes, provision for regulating the humidity of the air and the proper outlet pipes for injecting the fresh air into the factory, together with the ventilators for the exit of used air.

FIRE PREVENTION EQUIPMENT. In the design and construction of factory buildings, much attention should be devoted, both in the type of materials used and in the construction adopted to the prevention of fire, and to the restriction of the damage in the event of fire, to as small an area as possible. Insurance companies to-day insist that factories in which the fire risk is appreciable, shall be equipped with automatic sprinklers. These consist of a series of pipes supported at regular intervals over the floor space. A fusible link in the valve melts at such a temperature as endangers the safety of the factory, and releases a spray of water, which issues from the valve and continues to spray until the water supply is cut off.

While smaller factories have to rely on local professional fire brigades, larger factories usually have voluntary fire brigades, recruited from their own staff.

POWER GENERATION AND TRANSMISSION. Certain industries operate under conditions which directly influence the solution of their problems of power generation. "Iron and steel works have so called waste gas and waste heat from which power can be obtained; collieries, large quantities of fuels and coke and gas; saw mills and carriage and wagon works, a quantity of timber refuse, and exhaust steam



A MODERN HYDRO-ELECTRIC GENERATING STATION

Contrasting with illustration on page 39, and indicating that by means of electrical transmission energy can be distributed over a wide area

from smithy hammers, while in sugar works, etc., the demand for steam for manufacturing processes may exceed the demand for steam for power."¹

The broad types of power generation comprise the following systems—

(1) Steam generation in boilers and its use either through reciprocating steam engines or steam turbines, and power distribution through belt or rope drive on to overhead lines of shafting.

(2) Steam generation and its use in steam turbines for the purpose of driving electric generators, the electric power so generated being distributed throughout the factory by cables and transformed into mechanical power by means of electric motors where required.

(3) The use of gas or oil as a fuel in gas or oil engines respectively, and its distribution either direct to line shafting through belt or rope drive or through transformation into electric power and distribution through cables with consequent reversion into mechanical power by means of electric motors.

It can be generally asserted that all systems of power generation and transmission have their special uses, and that probably in any one given factory of average or large dimensions, two or more systems should be used. Much discussion frequently ranges round the question of the system of power generation to be adopted, and in this connection, it is well to bear in mind that the cost of power represents only a very small percentage of the total cost of manufacture of most products.

During recent years, the adoption of what is known as individual drive for machine tools has been strongly urged by the advocates of electric power. Where machine tools are of large size and therefore require big amounts of power, this system is distinctly

¹ Elbourne, *Industrial Administration*.

advantageous : it involves an electric motor being placed alongside each machine tool unit, and such a motor can be designed to work efficiently with widely varying loads. In the case of smaller machine tools, which do not justify separate electric motors, it is usual to use one electric motor for driving a small group of similar machine tools. In general, the greater the sub-division of machine tools, the more economical the system is.

CHAPTER V

THE ORGANIZATION OF A FACTORY

MANUFACTURING AND COMMERCIAL ORGANIZATIONS

THE organization of a factory may be divided into three main groups, viz., the manufacturing, commercial and financial organizations, the manufacturing organization being that part of the factory which is responsible for the transformation of raw material into finished saleable articles, the commercial, that which conducts the selling of the products of the factory, and the financial, that which deals on the one hand with the financial records of the company and on the other with works costing. These three groups are closely inter-linked, as will be found in the notes which follow on the internal organization of each separate group.

MANUFACTURING ORGANIZATION

In order to illustrate one form of organization, reference is made to the various departments which go to form the manufacturing organization of a modern engineering works.

DESIGNING DEPARTMENT. All products before being manufactured in the factory are designed in the drawing office. In engineering and similar factories, draughtsmen form an important part of the personnel, their scientific and technical training being completed by supplementary actual experience of the works manufacturing processes. Upon the design of a product depends the facility and cost of its manufacture, and frequently initial designs and drawings are radically changed before leaving the drawing office for the factory. From this point of view the drawing office is an area of experiment—experiment which

would prove very costly if carried out in actual materials in the factory. Before a design leaves the drawing office, calculations are made respecting the quantities of materials that will be required for its manufacture, and this information appears as a "bill of material" at the foot of the drawings, and becomes the basis for ordering material through the purchasing or buying department.

RECEIVING DEPARTMENT. In general the same procedure holds good for all materials purchased by any given factory on arrival at the works. Either an advice note is received from the sender informing the works of the amount and character of material which has been dispatched, or the first notification the works receives is the arrival of the carter carrying with him a delivery sheet on which the particulars are entered of the goods to be received. In this case, after the material has been unloaded and checked with the information set out on the delivery sheet, a representative of the factory is required to sign this sheet as evidence that the factory has received the material.

So also in the case of material received by railway, the railway company's delivery sheet or book has to be signed by a representative of the factory. It frequently happens that material has been damaged in transit to the works, or that a short amount has been received, and in this case the factory is required to report the deficiency to the railway company within three days, when if the claim is sound, compensation may be obtained. The raw materials received into the factory are placed in store in the manner indicated below.

MANUFACTURING DEPARTMENTS. The manufacturing departments take the raw material which enters the factory, and perform work upon it in such a way as to change its state, this often involving a series of manufacturing processes. In the case of the motor

car industry, the casting, machining and erection of the engine parts, the making of the magneto, the manufacture of the axles and steering gear, etc., are processes which are carried out in the manufacturing departments.

In some of these processes the major portion of the work is performed with expensive machines operated by skilled workmen, whereas in others little mechanical equipment is required, as the various parts are fitted or assembled together by hand labour. Usually in this latter type of work the component parts are of considerable weight and are expeditiously carried and carefully placed in position by various lifting and positioning contrivances.

In considering manufacturing departments of a factory, it is possible to distinguish two main types. One type accepts raw material entering the factory through the receiving department and produces component parts of the finished product—for example, in the case of the motor-car factory, there are engine parts, front and rear axles, differential gear, etc. The other type accepts these semi-finished parts and produces complete assemblies, such as for example, referring again to the motor-car industry, the complete engine, the assembled chassis, and ultimately the completed car. These two types are known respectively as feeder departments and finishing departments.

STORES. The receiving department of a factory is a distributing centre to various stores from which material is obtained for manufacturing purposes. In a large works it is impracticable, because wasteful, to send to one central stores for all materials, as considerable time would be spent in transport to and fro. In practice, therefore, stores are distributed throughout the factory. Thus, in the case of the motor-car factory, the stores containing lengths of steel bar for piston rods and engine shafts is placed

near the department in which these parts are machined, rubber tyres in a small stores near to the axle assembly departments, and so forth.

Goods entering the receiving department would, after inspection, be transported to an appropriate stores. Responsible for the control of each of these stores is a storekeeper, whose functions are, first, to ensure that receipts are obtained for all material issued from the stores to manufacturing departments, this record being of importance as part of the costing system, and second, to maintain in store sufficient stocks of materials to keep the manufacturing departments adequately supplied, and when stocks become small to place orders for fresh supplies.

INSPECTION AND TESTING. It is of the utmost importance that every piece of material shall, after the necessary manufacturing operations have been performed upon it, be of the right dimensions and of suitable quality to take its part in the finished product. This involves proper inspection of component parts, and it is usual in factories to appoint inspectors—men skilled in the work they supervise and trained in detecting faulty workmanship—to undertake this work. Not only, however, does inspection relate to quality and accuracy of workmanship, but also to quality of materials, and the earlier defects of any kind are discovered, the greater the resulting economy, for additional work on defective parts is then prevented. It is usual to introduce inspection at intermediate stages in manufacturing processes in addition to the complete inspection of the finished product. From the point of view of organization, it is desirable that inspectors should be independent of the individual—usually a foreman—responsible for obtaining a maximum output from a given department, as in striving after a large output, consideration for quality and accuracy is apt to be lightly regarded.

In the second place, a large number of products, especially mechanical contrivances, need to be tested under conditions similar to those under which they will be required to operate in service. So important is this factor in certain industries, that special testing departments form an integral part of the works organization.

TRANSPORT SYSTEM. By a works transport system is meant the handling, either by hand or truck or other method, of all forms of material, and the carrying of all material between stores, from stores to manufacturing departments, and *vice versa*, and between manufacturing departments. Where an efficient transport system is in operation, all manufacturing departments are regularly supplied with raw materials, and, on the other hand, completed articles are rapidly shipped from the departments. In general, the shorter the time it takes for material to pass through the factory in its journey from the raw state to the finished product, the more efficient is the works. Material should not be allowed to lie idle at any point in its journey, and when this fundamental fact is fully realized the importance of an efficient transport system is appreciated.

In addition to an efficient system for the transport of materials, in any large factory the equivalent of a postal and telephone service is essential in order to transmit quickly messages and information from one part of the factory to another. It will be found, therefore, that in practice most modern factories have a mailing system installed, the headquarters of which corresponds in many respects to an ordinary sorting room of a post-office. Juvenile employees are usually responsible for the collection and delivery of letters, and journey round the factory for this purpose at regular intervals, collecting letters from the "out mail" box or basket and delivering them into the

"in mail" box or basket. These boxes or baskets constitute the "letter boxes" of the particular departments.

SHIPPING OR DISPATCHING. The finished products of a factory, when ready to be delivered to the various customers, leave the works from a special department known as the "shipping" or "dispatching" department, a large section of which is required as storage area to house the products temporarily before they leave the factory for customers. The officers responsible for the control of the "shipping department" issue to the workmen who pack the goods ready for final shipment, instructions indicating the character of material to be shipped, its destination, the route to be followed, and the packer in turn enters on his form the number of the packing case in which the product is contained, together with the overall weight. At the same time, the various railway companies, steamship companies, etc., concerned in transporting the particular consignment are notified, and this results in various types of responsibilities being accepted by the transport companies and by the receivers respectively.

In considering the shipment of goods by railway, the selling price might be qualified in one of two ways, either carriage paid or carriage forward. In the former case, the factory which sends the material, known as the "consignor," pays for the carriage, and this is described as Free on Rail, or F.O.R. In the latter case, the customer who receives the goods, known as the "consignee," pays for the carriage, and this is known as "carriage forward."

Most factories have a fairly extensive trade, and this involves sea, in addition to rail, transit. New complications then arise. In the first place, the steamship companies charge for carriage of goods at a certain rate per ocean ton, an ocean ton being usually either

forty cubic feet or twenty cwt. The reason for this alternative is that certain goods, while light in weight, may be extremely bulky and occupy a very large part of ship's hold. It would obviously be unwise on the part of the shipping company to accept a large cargo of this type of product if the rate was at so much a ton of twenty cwt.

For home sea traffic, that is, traffic within the British Isles, most goods are usually sent F.O.B., meaning Free on Board, whereby the factory sending the goods pays for the carriage until they are placed on board the ship, from which point onwards the consignee, or receiver, pays carriage charges. For this type of traffic, the steamship company undertakes its own insurance of goods against all types of loss during transit, and their carriage rates include charges on this account.

Foreign traffic is more complex. It is usual for the factory sending the goods to arrange its selling price so as to sell its goods on terms known as C.I.F., meaning Cost, Insurance and Freight, and goods sold on this basis are delivered direct to the customer, all freight charges, etc., being borne by the sender. In the case of all foreign traffic, Bills of Lading are issued by the steamship company for the goods deposited on board every ship. This is a form issued by the steamship company in which they signify having received goods on board the ship, and which is then sent to the consignor of the goods. The latter dispatches it by fast mail to the customer entitled to receive the goods, and, as the Bill of Lading travels on its ocean journey in a fast packet boat, it usually reaches the customer well in advance of the goods, which are carried in a slow cargo vessel. The Bill of Lading constitutes the title deed of the customer to the goods, and it is only when he can produce it that the steamship company will release the goods arriving from a foreign port.

When goods are sent C.I.F., the sender also insures

them against damage or loss, and the insurance certificate is forwarded to the customer along with the Bill of Lading. It will be seen from this brief account of the work of a shipping department in a factory that this department must possess special knowledge or world geography and commercial practice. It has to decide on the best route by which goods should be sent, and negotiate with railway companies, steamship companies, and road transport companies.

COMMERCIAL ORGANIZATION

The commercial organization of a factory, it has been noted above, is that part of the administration which relates to the selling of the products which the factory manufactures. The actual process of selling—by which is meant the delivery of goods to a customer and the collection of the money—is only a part of the complete commercial organization. The delivery of goods is usually the consummation of a chain of preliminary work on the part of the commercial organization, and in studying this branch of industrial administration it is impossible to isolate it from those other branches with which it is in intimate contact.

The commercial department of a factory has been described as a “middleman department,” which means that it stands midway between, on the one hand, the consumers of the manufactured product—the customers, and on the other hand, the producers of the product—the workers. It is essential, therefore, that the commercial organization should be thoroughly conversant with both these parties, as it is only through its medium that the one can come into contact with the other. It is useless for a factory to manufacture what is not required by a consuming public, but on the other hand, an efficient commercial organization can do much to educate the public to appreciate the value of a product which can be readily manufactured.

The commercial organization may be analysed in more detail by an examination of its functions, which may be considered to be three in number—

- (1) Securing Markets. (2) Supplying Markets.
- (3) Maintaining Markets.

(1) SECURING MARKETS. Before an industrial concern can enter into competitive business it should definitely decide upon its selling policy. Two main alternatives present themselves: on the one hand, an enormous number of single sales may be the goal, and, on the other hand, the object may be to secure customers, who, having once bought, will buy regularly. A wise and well considered selling policy always favours the latter course. The concern that adopts this policy will of necessity be compelled to pursue a "quality and service" policy. The phrase "quality and service" is one that has arisen in America, and is the description of a selling method that has resulted in large and regular sales. It assumes that only the very highest grade of product is marketed, that its properties are completely known by all salesmen, and that from the raw material down to the last finish of the package in which the article is sold, the highest quality is aimed at and the best taste displayed. In this way the foundation of future sales is laid.

Markets may be secured by two general methods, one the impersonal and the other the personal method. The impersonal method is that of advertising, and in recent days this has become a very highly developed and scientific business. Broadcast advertising in the public highways and the public press is only applicable to certain types of products, chiefly those of everyday use, and those in demand by the whole or major portion of the community. Special products having an application in a particular direction or appealing only to a limited number of people, are advertised, but

then only in a limited section of the Press—often trade and technical journals. There is but little doubt that while some public advertisements are quite successful, an enormous amount of money is usually wasted by this method; it is also very difficult to estimate the success of an advertisement of this character. Advertisements usually become wasteful just at the point when discrimination disappears. So long as great care is exercised in selecting the type of advertisement and of the medium of advertising and in determining the frequency of insertion, usually good results are produced, assuming, of course, that the product under consideration is of a type suited to advertisement of this order.

Modern advertisement has become a fine art, and rules for advertisement have been drawn up as a result of a careful study of certain broad scientific principles. The study of advertising methods involves a close analysis of the psychology of the customer, and training classes in advertisement are conducted in most parts of the country. Many individual firms, recognizing the importance of effective advertisement in increasing sales, conduct training classes in advertisement and salesmanship on their own premises.

As indicating the preliminary study which is often undertaken by large industrial concerns prior to the issue of advertisements, the case may be cited of a concern manufacturing tractors, which detailed one of its most able salesmen to tramp from farm to farm learning what arguments would induce farmers to purchase tractors. The information thus obtained has since that time formed the foundation of that concern's advertising.

So far, the impersonal method of advertising has been considered. The other method is one which carries a personal touch, and for some classes of goods is much more effective than the first. Personal

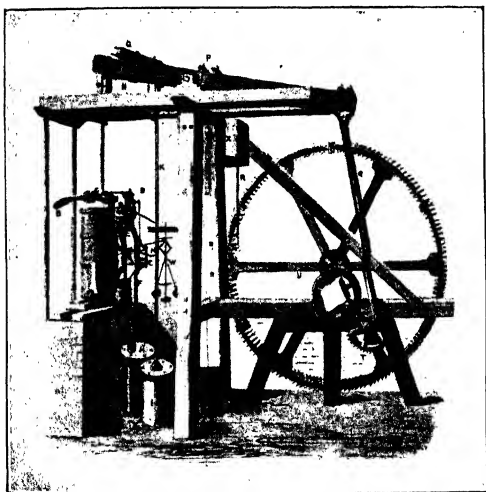
advertising is conducted through the selling force, usually on a territorial basis, and if the product to be sold is one that appeals to a special class, then a list is compiled of likely customers and a systematic canvass made. The primary function of this canvass is to bring before the notice of possible buyers the qualities of goods to be sold, and the salesman approaching the problem of advertisement in this way usually aims at merely calling attention to the existence of the products in question and does not necessarily endeavour to force a sale.

(2) SUPPLYING MARKETS. After markets have been secured the continual supplying of these is more a matter for sales office organization rather than field organization. The conditions of sale have to be determined and papers drawn up embodying such questions as price, quantity, quality and terms of payment. The contract of sale is the most important document connected with a commercial transaction ; it protects the seller as much as the buyer. A contract drawn up with accuracy in every detail specifying completely every condition of sale, invariably avoids disputes or misunderstanding at the time of settlement. So important is the subject of commercial contracts that a short consideration of their form will be made. A contract is an agreement between parties and is enforceable by law. There are two main classes of contracts viz., agreements under seal, sometimes called deeds or specialty contracts, and simple contracts.

The agreement under seal must be a written contract, and it is applied in cases like the transfer of property and conferring of powers of attorney, etc. It does not usually apply to ordinary commercial contracts.

Simple contracts may be written or merely made verbally, although in general, the former type is the one that applies in commercial bargaining. The law of contract requires that in the case of simple contracts

there must be what is called "consideration" before the contract is valid. "Consideration" implies that there must be a benefit obtained by one of the parties. The law does not look upon consideration from the point of view of adequacy or inadequacy, but is satisfied if it merely exists. Consideration in practice



WATT'S STEAM ENGINE

takes the form of a deposit, and in small sales this is usually insisted upon; in larger sales, however, the good faith of the customer to pay when the bill is presented is accepted as sufficient although it is usual for manufacturers to require a fairly large part payment for goods before they are actually delivered.

We may, therefore, regard a contract of sale as being a simple contract in writing. It is an explicit

statement setting out in full detail a specification of the goods to be delivered, of the terms of payment, of the conditions of delivery, and finally of the price at which the goods are offered. In the first place such a statement may be regarded as a tender, and if after the customer has duly considered it he agrees to accept the tender, an official order is sent by him to the manufacturer. If in the meantime any changes in price have taken place or deliveries cannot be kept, the customer is notified of the change.

It has been stated that it is usual for manufacturers, through the medium of their commercial organizations, to sell products to customers on the promise of future payment. Naturally, before they accept orders on this basis they need to be assured of the credit standing of their prospective customers.

The commercial organization of a concern always contains, therefore, one section whose sole function it is to approve credit. The soundness of a customer's credit usually depends on the personal character of the customer himself, and on the state of his business, both of which it is the function of the credit section to investigate. The most satisfactory test of credit is a declaration by the customer himself, and this is frequently required from new customers who ask for extensive credit. Other sources of credit information are banks and credit agencies, the latter being commercial enterprises developed for the express purpose of supplying commercial organizations with information respecting the credit of prospective customers. Such credit agencies are usually much more satisfactory than the banks, which display much reticence in providing credit information.

In the preparation of a contract of sale the question of price will be probably the most important consideration. It is usually the ultimate criterion of business, and in competitive industry very fine price adjustments

have usually to be made. There are two principal factors in price adjustment which give respectively differential and discriminate prices. Differential prices are those which vary according to quantities bought and where a reduction in price is made for large quantities. Discriminate prices are those which vary with the granting of price concessions to certain customers or groups of customers, and this practice frequently extends to price agreements between groups of mutually competitive firms, and in practice becomes exceedingly ramified.

(3) MAINTAINING MARKETS. We have already referred to chance sales and regular sales, the former being the result of spasmodic effort, and the latter only coming through a well organized and carefully managed selling policy. Markets may be secured and supplied, but unless a conscientious attempt is made to maintain such markets, it will probably be found on desiring to re-open any particular business that the door is closed.

In order to assist in the maintenance of markets once established, a very close link should be established between the selling and manufacturing organizations of the concern. The selling force, being in constant contact with customers, becomes familiar with their requirements and can, therefore, reflect to the manufacturing organization the attitude of customers. Close contact between these two sides of an industrial concern may result in recommendations for the changed or modified design of a product, the manufacture of a new unit of product, or merely in recommendations respecting such matters as finish, packing, etc.

It is realized by all industrial concerns that not merely should salesmen have ample opportunities of coming in close contract with the manufacturing organizations, but that they should themselves come together at regular intervals to discuss matters of

common interest, and to provide the opportunity for those responsible for the direction of the selling organization to imbue salesmen with the spirit and policy of the concern with which they are associated.

It is obvious that much depends on the personality of the salesmen. The utmost care is exercised in their selection, and having chosen the best type available, they are then usually required to undergo a course of intensive training. Respecting the administration of the selling force, one writer has summed up the position very appositely in the following words: "The old method of supervision was to divide the territory, pay satisfactory salaries, and leave the men to work out their own salvation." The new system is to control the order in which the men travel their routes, fix the prices and terms to be offered, pave the way for calls upon customers by literature sent in advance, keep in almost daily stimulating touch with the men and make them feel their records are constantly watched, and that they will be advanced in proportion to their ability to earn profits.

Apart from allocating salesmen to well defined territorial areas, it is usual to compile office records showing the distribution of sales on a geographical basis. A large scale map showing the density of sales at different points is prepared, and a close analysis made of the reasons for small sales in certain areas. A systematic study of the problem in this way frequently results in steps being taken to increase sales in these areas. On the other hand, in the case of special products it is possible to prepare a similar map showing the total consuming capacity of geographical areas for the product under consideration. The difference between the actual and possible sales gives a measure of the new sales that may still be obtained, and this information may form the basis of a sales programme.

CHAPTER VI

THE ORGANIZATION OF A FACTORY (*contd.*)

FINANCIAL ORGANIZATION

THE accounting department of a company deals with the financial organization, and comprises the financial records of the company and the works costing. Some consideration is here given to the functions of the accounting department in a limited liability company.

FINANCIAL RECORDS. A company's financial records consist of three elements—

(a) *Capital Account* in which the company's liabilities are balanced against its assets, giving the Balance Sheet of the undertaking.

(b) *Trading Account*, which represents the balance of work done by the concern, and in which items of input such as labour, material, overhead charges, etc., are balanced against the cost of goods, services, etc., which constitute the output of the concern.

(c) *Cash Account*, which is confined to a statement of money transactions, and where income from sales, etc., is balanced against total expenditure.

(a) **BALANCE SHEET OR CAPITAL ACCOUNT.** A Balance Sheet is a statement showing on the left side the balance of the amounts that have been received, or are owing, by the company or firm that issues it; and on the right side the amounts that have been paid out by it, or are owing to it, or are held by it. On its left side are the liabilities, on the right the assets of the company.

For purposes of illustration, a specimen Balance Sheet is appended, from which, in order to make its purpose clearer, details have been removed.

INDUSTRIAL ADMINISTRATION

BALANCE SHEET

Capital . . .	£1,000,000	Buildings & Plant. . .	£500,000
Creditors . . .	200,000	Work in Progress, . . .	
Reserves . . .	100,000	Stocks . . .	300,000
Profit & Loss A/c. . .	100,000	Debtors . . .	400,000
		Investments . . .	100,000
		Cash . . .	100,000
	<hr/>		<hr/>
	£1,400,000		£1,400,000
	<hr/>		<hr/>

Liabilities. Analysis of the liabilities shows that they include capital due from the company to its shareholders, reserves, and Profit and Loss Account, which is the undistributed balance of profit.

Matters relating to the recording of a company's capital are dealt with by the secretarial staff, and procedure is standardized according to statutory requirements embodied in the various Companies Acts. The company's secretary is the person held responsible for the accurate keeping of records relating to shares and shareholders, transfer of shares, payment of dividend, issue of notices and convening of meetings, and this compilation is systematically undertaken by him usually on standard forms and by standard methods.

Reserves are essential to provide for contingencies. As to what size of reserve fund shall be carried, or what percentage of net profits allocated to reserves depends upon conditions obtaining from year to year, together also with the nature of the business. The Profit and Loss Account appears on the side of liabilities, provided it is in the form of a profit, and on the side of the assets if the year's working had shown a loss. It is only after a company's annual general meeting at which the Balance Sheet is presented that the Profit and Loss Account becomes available for distribution as dividends, etc., and then only subject to the condition that the Balance Sheet has been adopted by the meeting. The Profit and Loss Account

is then distributed to dividends, general reserves, special reserves and balance carried forward.

Assets. Analysis of the assets shows that they are of two kinds, fixed assets, including buildings and equipment, and floating assets, including stocks, outstanding debts, investments and cash.

In considering the value of assets it is important that the real value should be shown. Especially is this so in the case of buildings and plant. There is usually a distinct difference between the real value of buildings and plant and their book value, which latter is obtained after due account has been taken of depreciation. The need for care in estimating the real value of assets is indicated by the following considerations—

In the event of the concern changing ownership the question of the selling price arises, and although the book value might stand at a very low figure the seller would be right in expecting a high selling price if the real value of the assets is high.

The buildings and plant should be insured at their real value and not at their book value, as in the case of fire or other cause of damage it is the real value which has to be replaced and not the book value.

When the contribution of the company's capital is considered, debenture stock is frequently issued. In this connection, a prospective debenture holder should satisfy himself as to the real value of such securities of debenture stock as buildings and plant. In general the total amount of such stock should be less than the recent valuation of such property, in which case something could be realized for debenture holders in liquidation.

Finally, it should be indicated that the Balance Sheet is a statement primarily designed in order to determine a rate of dividend and is of little help as a guide to financial control of a concern. In fact,

one authority says: "The only Balance Sheet which can be said to state the true position is the liquidators' final winding-up statement, and this in successful industrial undertakings will never be written."

(b) **TRADING ACCOUNT.** The function of this record is to determine whether the factory—viewed as a production department—is making profit or not. It is obtained by balancing input and output and need have no reference to the stocks in any works or section

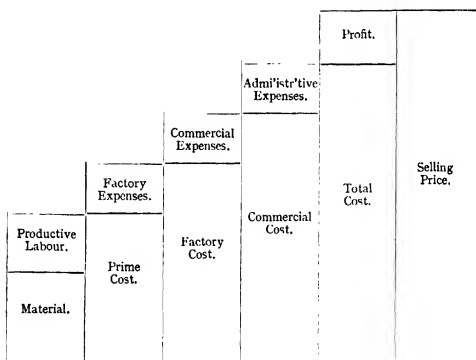


FIG. 5

of a works. On the debit side of this account appears cost of sales, and on the credit side sales results.

It is essential that a clear conception be obtained of what is implied by "cost of sales." Before analysing this term it will be helpful to examine how the selling price of an article is made up from various component elements, and the attached diagram (Fig. 5) will make this building-up process of selling prices clear.

We are now in a position to analyse what is implied by "cost of sales," or using another term, "factory

cost." Three items are included in cost of sales, namely—

(a) Cost of productive material used on all jobs, sold during the period of record.

(b) Total of productive wages paid on all jobs sold during the period of record.

(c) Total of factory expenses or overhead charges incurred on all jobs sold during the period of record.

Item (a), i.e. productive material, can readily be ascertained, as all material used is indicated in specification or order sheets issued to the shops, or by requisitions calling for material. As each job bears a distinctive number while passing on its journey through the shops, the posting of costs against a given job is a straightforward matter.

Item (b), i.e. productive wages, again presents no difficulty. All such wages are posted against the number of the job on which labour, so recorded, has been spent, and in this way careful records are kept.

Item (c), i.e. factory expenses, or as they are sometimes described "overhead charges" or "on costs," do not admit treatment quite so simple. Factory expenses include labour of a non-productive character, works supplies and miscellaneous charges.

We have thus far seen that matters relating to the recording of the Trading Account are of a far-reaching character; in fact they embrace the whole field of cost accountancy. In order to illustrate the importance of this phase of accounting records it will be convenient to set forth the fundamental requirements of an efficient works costing system. From an analysis of these requirements it will become clear that the cost accountant not merely controls the works accountancy and in many cases directs the keeping of suitable records, but is able to allocate sources of waste and point to inefficient methods of manufacture.

(c) CASH ACCOUNT. As has been earlier indicated,

the Cash Account is confined to a statement of money transactions and summarizes the work of the cashier's department of the manufacturing concern. All money incoming from all sources, including sales of goods, of services, of scrap and of by-products, etc., and from investments and other sources, is balanced against the total expenditure.

WORKS COSTING

Although in dealing with the Trading Account in the present chapter the principles of works costing have been touched upon, their importance is so fundamental that it is proposed considering in further detail the requirements of a costing system and the method in which it generally operates.

FUNCTIONS OF A COST SYSTEM. The functions of the works costing system are briefly as follows—

(1) To ascertain the cost per unit of each line of a factory product. This information will be of use not merely from a selling point of view, but also to the company's management when considering future policy.

(2) To facilitate comparison of costs obtainable for different periods and under different conditions.

(3) To assist in reducing the cost of production by analysis of each composite part of the product, and the operations affecting the same.

(a) So far as possible sectionalized job costs should be given. The case of two products may be considered, the first one of which incurs high costs in the early operations ; and the second one having high costs in the later operations. Proper costing would draw attention to this fact, so that further turbines should be built with least cost in all operations.

(b) In the costing of multiple operation jobs, the cost of scrap on each operation should be indicated.

At one factory manufacturing cartridge cases during the war, this information proved invaluable and brought to light inefficient methods of production and waste of material.

(4) To assist in the elimination of waste, whether from idle time, defective design, material, or workmanship.

The cost system must be flexible. No system of costing can be applied without modification to different manufactures. If the cost of a shell is considered, the cost of which was an important consideration during the war, it is possible to take the costs of a job over various operations, and from the average of these figures, arrive within very close limits at the cost of one shell. This method, however, is not applicable to large machines made in single units. In the case of large machines of special types, each item must be separately costed.

FACTORY EXPENSES OR OVERHEAD CHARGES. Over any given time the total amount of factory expenses incurred in a factory can be readily ascertained, but the difficulty consists in deciding on a right method of allocating such charges to individual jobs, i.e. how to spread factory expenses over work passing through the shop, and how to forecast what amount of factory expense a given job should bear, even before the exact amount of those incidental expenses can be determined by a direct method of calculation.

Several methods of distribution of factory expenses exist, the most important of which are—

- (1) A percentage on productive wages.
- (2) A percentage on productive wages and material.
- (3) On basis of expense per productive hour.
- (4) On basis of machine hour, and group machine hour.

(1) *Productive Wages Method.* By this method the total of factory expenses for a given period in a given

department is compared with the total of productive wages paid on all jobs during the period of record, and in this way a factory expense ratio is established. Thus, if the total of factory expenses over a given period was £750, and the total of productive wages paid during that period £1,000, then clearly the factory expense ratio equals 75 per cent. In costing, therefore, a job on which 8s. was paid as direct labour would bear 75 per cent of 8s., i.e. 6s. factory expense.

(2) *Productive Wages and Material Method.* This method is similar to the one considered above with the exception that it takes the total cost of productive labour and material as the basis, instead of the productive labour only. The application of this method is confined practically to those cases where the material forms the greater part of the direct cost of the product.

(3) *Productive Hour Method.* This method is based on the amount of the workman's time instead of productive wages. The factory expenses are distributed according to the hours worked instead of the wages the employees receive.

(4) *Machine Hour Method.* According to this method, the factory expenses are distributed so as to show the total cost per hour of operating the machine.

Space prevents a detailed analysis of each of these methods, but a simple illustration will serve to indicate the relative conditions of certain methods.

For example, in machining departments the question arises whether factory expenses should be distributed on the basis of wages paid to the men operating machines or upon the hours the machines work. Assuming that, in the former case, the factory expense ratio is 100 per cent, and in the latter case the particular machine under consideration is rated at 1s. 6d. an hour as regards factory expenses, and that we take the case of a man whose wages are 2s. an hour and also that of a boy whose wages are 1s. an hour performing

a job which occupies one hour, then the two cases are shown below.

CASE 1. (Productive Wages).			CASE 2. (Machine Hour).		
	<i>Man</i>	<i>Boy</i>		<i>Man</i>	<i>Boy</i>
	<i>s. d.</i>	<i>s. d.</i>		<i>s. d.</i>	<i>s. d.</i>
Labour . . .	2 -	1 -	. . .	2 -	1 -
Factory Expense					
(100%) . . .	2 -	1 -	. . .	1 6	1 6
	<hr/>	<hr/>		<hr/>	<hr/>
Total . . .	4 -	2 -		3 6	2 6
	<hr/>	<hr/>		<hr/>	<hr/>

The fact that a boy operates the machine and not a man does not mean that any large amount more of overhead charges are absorbed by a job, although there is good reason to believe that owing to the presence of the boy a small amount more of overhead charges should be absorbed. This condition is obtained by the machine hour method.

This consideration shows that there is much in favour of charging against the hours worked by the machine and not on the wages earned. This has a further advantage that where the machines are numbered and this number is shown on the job tickets, a record can be kept of the hours the machine runs over a period. Thus some knowledge may be obtained as to the possibilities of expansion of output from any one or from a group of machines.

In carrying this method of allocating overhead charges to its logical conclusion, each individual machine would be considered on its own merits and a factory ratio determined for it. Clearly in the case of small machines this is impossible, but it is quite possible to group a number of small machines having similar characteristics together and assign a ratio for the whole group, and in practice this is how the method actually operates.

Depreciation. The factor of depreciation is accounted for in the company's Balance Sheet, in which the item appearing in the assets entitled "Buildings, Plant, etc.,"

of one year's Balance Sheet corresponds to that of the previous year less depreciation, plus, of course, any additions made during the year. The matter is of importance from an engineer's point of view, and on this account special attention is here devoted to the subject.

Depreciation is of a two-fold character, comprising—

Renewals or provision for the diminution in the value of plant by reason of causes outside the control of the manufacturer, such as age, wear and accidents.

Improvements or provision to enable a manufacturer to take plant out of commission before its physical life is exhausted in cases where it is economically desirable to do so. This factor is frequently referred to as "obsolescence."

It is impossible to lay down standard rates of depreciation for all plant or any sections of plant, as there will always be differences in conditions. It should be clearly borne in mind that depreciation is more than a question for the accountant, being one in which the engineer, if the concern is to be successful, must be closely consulted.

In general there are three methods of depreciating plant—

(A) Depreciating by a fixed percentage on the original amount. This gives a straight line curve.

(B) Depreciating by a fixed percentage on the depreciated value. In this way depreciation is rapid in the early years and diminishes as time increases.

(C) Allowing little for depreciation in the early years, but increasing this as the life of the plant increases. This method has much in its favour, and appears to be a logical procedure.

These three methods of allowing for depreciation are indicated in the accompanying graph (Fig. 6).

The guiding principle should be regularly to depreciate all plant year by year by a fixed percentage.

This at any time gives the "book value" of the plant. The value should never be completely written off while any piece of plant remains in commission: a low nominal value should be retained even after a machine has outlived its "book life" as determined on a depreciation basis.

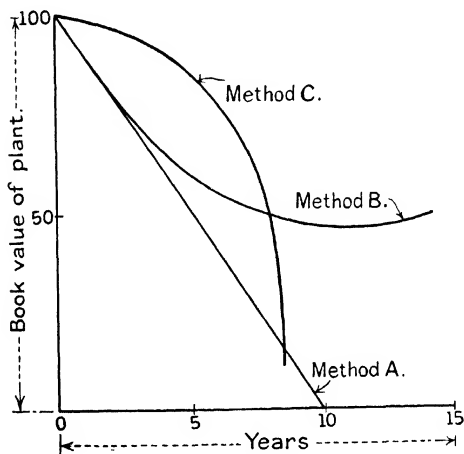


FIG. 6

New difficulties are introduced into the already much-vexed question of depreciation when a depreciated currency has to be taken into account. In these days of increasing money values plant has not merely to be replaced, but this has to be done at its "replace value." This may sound obscure, but an illustration will make it clear. If a lathe, purchased ten years ago at a cost of £500 has been depreciated at 10 per cent per annum on the original cost, due provision has been made to replace it to-day (now that

ten years have elapsed) at its original value of £500, assuming that the straight line method of depreciation be adopted. Its catalogue price to-day will, however, be of the order of £1,000. No provision has been made for this inflated value on a basis of depreciation allowances; it then becomes a question of financial policy as to how it is to be disposed of. Usually for such a purpose a percentage of net profits would be allocated to a special reserve fund.

Considering the other factor of "improvements," this should not be dealt with without regard to trade conditions. In any trade there are fluctuations, and periods of trade booms and trade slumps are experienced as much in the engineering industry as in other more well-known activities. When business is brisk and the shops are loaded with orders it is extremely unwise to undertake or even consider extensive improvements. The plan should be to run at as high a load factor as possible with the existing plant and equipment in order to secure a high production and earn money while the opportunity awaits. In slack times improvements to plant should be carried out and every use made of the non-rush period in order to prepare for the next busy period that is sure to come, when under improved conditions of manufacture competitors can be successfully met.

FINANCIAL CONTROL

Financial information is the only real means of controlling a business. Such information must be presented in a manner that will enable the Directors of a concern to keep in constant touch with the vital details of the business. It must be more than an occasional review: if possible it should be in the form of weekly returns, and in no cases should financial periods be longer than one month.

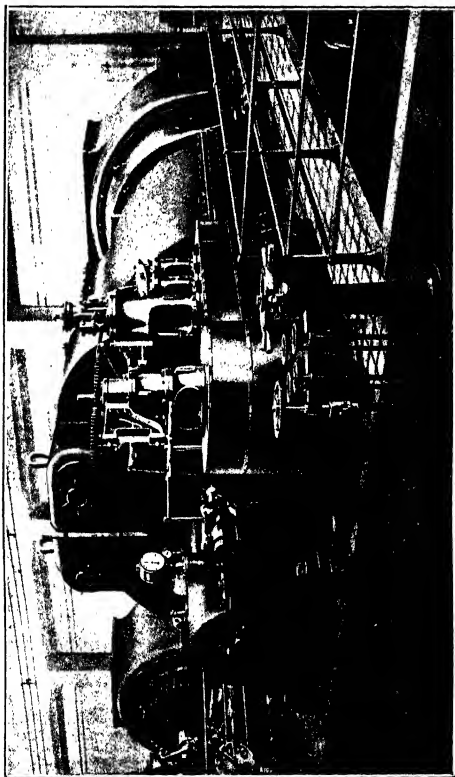
The financial controller should look further ahead

than any other executive in the concern. He should budget as far in the future as possible, and always avoid getting lost in detail.

Having regard to the fact that financial figures are for the management of the business, financial returns should be compiled to enable the business to be studied from a management point of view and not from an accounting point of view. Each responsible head of a department should see at a glance what he is spending and what he is earning.

By way of illustration of this principle the case may be cited of one firm's method of showing the manner in which overhead charges are made up. These expenses are presented monthly in a manner that can be easily understood by superintendents and foremen, as in many works the opinion is given that the overhead charges are empirically set by the management, and really mean nothing, being quite outside the control of the men in the shop. In the case quoted, these expenses are divided under three heads, A, B and C. Class A expenses cover some thirty-four items, each shown both as a lump sum per month and as a percentage of the total factory expenses. Each item is numbered for purposes of identification. These charges are purely shop charges. Class B charges are partly shop charges, which go directly to the department concerned, and partly charges which are divided between departments to which they are feeders. Class C charges are those which are distributed over the factory as a whole and over which the works personnel has little control.

Factory expense is a very vexed question in financial control. It is important that so far as possible the factory expense ratio is kept constant. The fact that so much attention is devoted to the subject by manufacturers and financial controllers is explained when it is realized that in general all manufacturers compete



A MODERN STEAM TURBINE

Developing 33,000 H.P. at 1,500 revs. per min., and contrasting with Watt's first steam engine shown on page 69

equally in labour and material, and the lowest selling price can usually be quoted only by the manufacturer who has the lowest overhead or factory expenses.

Good financial control distributes factory expense on a basis of normal output. Overtime reduces factory expenses, but if after a factory has been running on overtime for some time, an attempt is made to lower the selling price in consequence, then the works is faced with either always working overtime in future, or selling at too low a price where overtime is stopped. Similarly a slack period should not result in an increase of selling price, although owing to diminished output the factory expenses are increased. These variations are chargeable to the Profit and Loss Account, and it is at such times that one needs to distinguish carefully between cost and profit.

A manufacturer may desire to push a special line : a financial problem immediately arises. Under present circumstances the article may be too expensive. It is possible to calculate what would be the influence on the factory overhead expenses, and on the ultimate selling price, of such an increase in output as would materially increase the productive labour of a department, and consequently its power of absorption of factory expense, without increasing the latter in the same ratio.

An important record which the financial department of a works should regularly keep is statistics showing in any given works department the ratio of output to work in progress. This will be prepared on a money value basis.

The ratio of output to work in progress is a measure of turnover in any given department. The primary object of any department is to secure a maximum output for a minimum work in progress. In this way minimum stocks are carried and minimum manufacturing area required. Neither of these two factors

should be considered independently of the value of orders on hand, and it is usual to present all this information graphically, which offers a simple means of comparison.

Another illustration of the importance of the proper presentation of financial information arises in the following connection. A manufacturing concern may have extensive export trade. The financial department has detailed records in these cases, on a territorial basis, and shows how the company's trade is distributed throughout the world and what amount of profit is being made in each of the various areas. The record should go one step further than this and detail each territorial area according to the type of apparatus sold. In this way it would be possible for the company exactly to determine how any given type of apparatus was selling in any part of the world. These records might show, for instance, that a certain type of machine was selling at a distinct profit in South Africa but at a loss in Canada, whereas in the aggregation of accounts without this detailed analysis the whole might be presented as a profit, and the Canadian ready market be a source of congratulation. But it is easy to secure a market when selling at a loss. These records would clearly be prepared in the case of a concern having district offices in various parts of the world, but there are many companies who organize the whole of their business from one home centre.

CHAPTER VII

LABOUR

IN industry the human factor is of paramount importance, and despite the increasing application of machinery and the aggregations of capital in large industrial combinations, it is still the individual, whether as an operative at the bench or machine, a technician, or a member of management, who is primarily concerned in the economic conduct of industry. It is the purpose of the present chapter to analyse briefly the more important aspects of Labour and its varied organizations, as distinct from management, which will be considered later.

TRAINING

Youths who intend to become artisan workers have usually pursued a course of general education up to the age of fourteen to sixteen years, when they enter industry and serve an apprenticeship period which extends as a rule over about seven years.

Not all youths leave school at the age of fourteen. Some continue at more advanced educational institutions, particularly Central Schools, Junior Technical Schools and Secondary Schools. The salient features of each of these types of schools are briefly outlined below.

PRIMARY OR ELEMENTARY SCHOOLS. These schools were established by the Education Act, 1870, under the control of "School Boards," and since their inception have continuously developed in both organization and character of instruction. The Education Act, 1902, abolished "School Boards," and established "Local Education Authorities," which now control these schools. The Education Act, 1918, the provisions

of which are not yet fully operative, makes school attendance compulsory for all children between the ages of six and fourteen, and gives the Local Education Authority power to exercise compulsion in the case of children between fourteen and fifteen.

The curriculum of the primary school admits of considerable variety, but in general, the object of the training is to give boys a foundational knowledge of what are popularly known as "the three R's," i.e. reading, writing and arithmetic. In the modern primary school every effort is made to develop intelligence in boys and to turn them out from the schools as thinking boys rather than mechanical units.

CENTRAL SCHOOLS. Central Schools are intended to attract the best scholars from the upper classes of neighbouring Elementary Schools, and to provide a higher course than the ordinary school can offer. For purposes of administration they come under the same controlling authority as the Elementary Schools. Each of these schools has a commercial or industrial bias, or both, and the curriculum is specially considered and framed with the view of meeting the needs of the district. In all cases the curriculum provides for manual and practical work.

In general, it is intended that boys enter Central Schools, where a four-year course is provided, between the ages of eleven and twelve.

JUNIOR TECHNICAL SCHOOLS. Junior Technical Schools specifically cater for boys who, later, wish to enter industry as trade apprentices. The age of admission or transfer from the Elementary School should be from twelve to thirteen years of age. A two or three-year course is provided, so that the youth is ready to enter industry before his sixteenth birthday. The curriculum, while including subjects of general education, primarily comprises instruction of an industrial character, such as machine drawing, manual

training, etc. A small fee is charged but ample scholarship facilities exist.

SECONDARY SCHOOLS. Boys enter Secondary Schools at an early age, and it is generally intended that they should continue up to the age of, at least, seventeen or eighteen years. Certain boys, however, at approximately sixteen years of age, give evidence that their capacity can be turned to better account in industry rather than by their continued stay at a Secondary School.

As to the character of the educational career a youth should pursue before entering industry, this depends very largely on the individual capacity of the particular youth under consideration. Educationists are tending to-day to make a selection of boys at the approximate age of eleven years, promoting some to Secondary Schools, and leaving the remainder to complete their whole time education at Primary Schools.

From these various types of schools, youths enter industry between the ages of fourteen and sixteen years and train for artisan employment. Industrial training should provide for the efficient practical training of youths in a particular trade, instruction in the principles underlying trade practice, and the provision of appropriate advanced technical instruction for youths possessing outstanding capacity.

The first of these requirements—practical training—is primarily the responsibility of the employer who accepts youths as apprentices in his works, and is met in a variety of ways. In some factories special training departments are established, in which apprentices spend a certain initial period of their apprenticeship. In other factories apprentice instructors, who are skilled workmen, are appointed for the express purpose of giving practical trade instruction to the apprentices. Again, other factories simply rely on the existing facilities and normal organization of the

concern for the trade training of boys in their employ. No matter what particular system of trade training is adopted, considerable reliance has to be placed on the active assistance and loyal co-operation of adult workmen in furthering the practical training of apprentices who are associated with them.

But practical training in mechanical processes is only part of the complete training of the artisan worker, and most progressive industrial concerns to-day recognize this fact. Manipulative skill requires to be supplemented by classroom instruction in the principles underlying trade practice. To this end, many employers have established on their own premises schools at which their juvenile workers attend for a certain number of hours per week during working hours. During the first stages of works school attendance the curriculum usually provides for the revision and consolidation of the general education of the primary school, which is followed in the later stages by trade instruction in the scientific principles applicable to the particular trade to which the youth is apprenticed.

In the third place, provision should be made for youths of outstanding capacity to obtain advanced technical instruction. It is usual for elementary technical instruction to be administered through the medium of evening technical classes, but many Local Education Authorities are providing part-time day classes, usually during one day per week, for advanced students. Youths who make good progress in this instruction gradually acquire that equipment which will enable them to undertake more responsible and more technically difficult work in industry.

EMPLOYMENT

Factories require a variety of personnel ranging from management members to unskilled labourers, and including between these two classes skilled

tradesmen and clerical workers. The proper selection of this labour force is a function of management.

In the smallest factories the foremen frequently engage workpeople for their own particular departments, and no attempt is made to co-ordinate the requirements of different sections of the factory. As a factory grows, the promiscuous selection of workers usually gives place to a more systematic selection conducted through the medium of an Employment Department, which in the first place, undertakes the selection of employees for work in the factory, and in the second place maintains accurate records of the qualifications and services of each employee.

The selection of workers is the most important function of the Employment Department. Workpeople who are engaged without reference to their suitability for the particular type of employment for which they are selected, generally become dissatisfied, their work becomes unsatisfactory, and before long their dismissal follows. In this way a bad initial selection of workers leads to what is known as a "high labour turnover." This unsuitability of labour force is not only inefficient but expensive. These facts are accepted to-day by most large industrial concerns and every effort is made through the medium of the Employment Department to select the highest possible grade of workers. It is usual for the various factory departments to notify the Employment Department, through the medium of a requisition, of the additional help required and of the qualifications which candidates should possess.

For any vacancies a variety of applications are received, through either the Labour Exchanges or advertisement in the public Press, and considered, and usually by personal interview the most suitable applicants are accepted.

The keeping of adequate records of the qualifications

and service of employees is helpful in considering the promotion of workers. In a progressive factory, developing organization continually requires the appointment of additional staff, and wherever possible such vacancies should be filled from within the organization by the promotion of existing workers rather than by appointing new staff from outside the concern. On the other hand, discharging of employees should be carefully controlled, as an indiscriminate dismissal of workers tends to jeopardize the stability of labour force and any sense of injustice or insecurity on the part of the workpeople exerts an adverse effect upon the efficiency of the organization.

During recent years psychologists have undertaken considerable research on the subject of the selection of employees for industrial work, and in many instances, more particularly where repetition work of an unskilled character is concerned, have devised mental tests to facilitate the selection of workers possessing the innate capacity for the work under consideration. So far the application of psychological methods in industry is distinctly limited and likely to be so for some considerable period, owing on the one hand, to the enormous variety of industrial work, and on the other to the lack of psychologically-trained observers available for this work.

SYSTEMS OF WAGE PAYMENT

In the analysis of types of productive enterprises certain systems of wage payment have already been considered, notably those relating to co-operation and co-partnership. It is not the present purpose to outline the broad economic principles which underlie widely differing systems of wage payment, with a view to analysing either their economic or their ethical basis, but to consider the varieties of wage systems, all of which belong to one broad class, this

broad class comprising methods of wage payment most generally adopted in modern industry.

DAY WORK SYSTEM. The first method of wage payment, the oldest and undoubtedly the simplest, is the day work system. The worker is engaged at a certain weekly wage in return for a certain predetermined number of hours spent at his work. If he is present at his work during the full period, he receives the full wage and incurs a proportion of loss for any time lost. The essence of this system is that the worker is paid on a time basis and not on a basis of work done, that is, of products completed. From an employer's point of view, it is assumed that an employee works honestly and that within limits, time worked can be regarded as a measure of work done. Those who deprecate this system of wage payment advance as its great disadvantage the fact that all workers are treated alike irrespective of individual efficiency. It is clear that this system of wage payment admits of a great range in both quality and quantity of work done by individual employees. At the one end of the scale, a worker's product may become so poor in quality or so small in amount as to not make it worth his employer's while continuing to employ him, in which case he is dismissed: in the language of the economists, he has fallen below the point of marginal utility. At the other extreme end of the scale, we have a workman, who, by reason of ability and perseverance, produces a large output of first class work. Usually, before long such a workman will earn promotion. But it is clear that between these two extremes, a great variety of personal performance can range.

The day work system of wage payment corresponds most closely, for manual workers, to the salary basis for staff employees. Experience shows that this system of wage payment secures a greater measure of

accuracy and careful work than other systems, there being nothing to be gained in hurrying work merely for the sake of having it finished. The need for very close inspection is, therefore, not so pronounced under this as under other systems of wage payment.

PIECE WORK SYSTEM. In order to provide an incentive to effort on the part of the worker and to secure his interest in work done, the piece work system has been introduced. Innumerable forms of this system have been devised, some of which are quite impracticable and can only be regarded as paper schemes, whereas others have met with varying degrees of success and have, within limits, attained the objects for which they were designed. Chief among piece work systems of wage payment, because the simplest, is the straight piece work system, where a definite price is set per piece and the worker's wages are the product of the price per piece and the number of pieces completed in a working week. Such a system as this immediately gives the worker a very direct interest in the number of pieces, or operations, which he completes. It has been said that the surest and shortest way to a worker's interest is through his pocket, and this is the main reason for the success of the piece work system of wage payment.

It is usual, under this system of wage payment, to guarantee a certain minimum wage purely on a time basis, irrespective of the amount of work performed, in which case, supposing a full week's attendance to have been registered, the difference between the total piece work earnings and the guaranteed minimum wage rate of a worker is known as piece work bonus. Under these conditions, occasions may arise when the worker fails to earn his minimum wage on a piece work basis, in which case he goes into debt, from which he is freed by reductions of subsequent bonuses.

It is usual also to make allowance for a certain

training period in the case of new workers, the duration of this period varying according to the character of the work to be done. An appropriate wage is paid the learner during this probation period, at the completion of which he is put on a piece work basis, and from that point onwards, failures to earn piece work bonus is regarded as a sign of inefficiency, which, if continued, probably results in the dismissal of a worker.

Among large sections of organized labour, there is definite opposition to the piece work system of wage payment, and their hostility is not without a measure of just cause. Too frequently in time past have employers cut piece work prices, when through sheer industry, workers have earned very high wages, and such action on the part of employers has naturally been met with the policy of "ca' canny" or "going-slow" on the part of workers, especially when certain prices have been set too high and honest work would have resulted in extremely high wages. But in general, employers are no longer guilty of cutting piece work prices : in fact, it can be affirmed that only on condition of a process being changed is a piece work price altered. On the other hand, there are many instances of employers having raised low rates, in order to facilitate workers earning satisfactory wages.

The piece work system necessitates adequate provision for inspection, otherwise there is a danger of defective work resulting, merely in order to increase the number of completed products that can be booked on behalf of a worker. Any deficiency in management or organization, resulting in irregular or inadequate supplies of material or in imperfect manufacturing facilities, or in stoppage or breakdown of machinery, has an adverse effect on the workers, in reducing their speed or in bringing them to a standstill altogether. The piece work system imposes therefore, to a marked degree, upon the management the obligation for

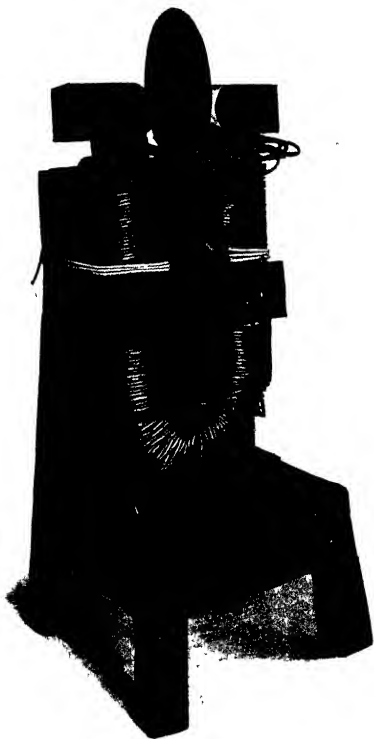
efficient organization, and at the same time secures the active co-operation of workers in attaining the same end. Where reduced output is brought about by conditions over which the workers have no control, such, for instance, as waiting for material or breakdown of machinery, compensations are frequently introduced by the management.

PREMIUM BONUS SYSTEM. It is clear, from the above analysis of the straight piece work system, that every saving of time on the part of a worker by increasing his output is turned in full to the worker's account. Each product completed or each operation performed, costs the employer the same in wages, and while not ignoring the saving which is effected on account of reduced overhead expense per product with an increased number of completed products, the fact remains that increased efficiency of the workers, whether brought about by special effort on their part or by provision of better working facilities, does not result in a direct gain to the employer.

The premium bonus system of wage payment aims at sharing the value of increased output between the worker and the employer. The most generally known schemes of premium bonus are the Halsey scheme in America, and the Rowan scheme in this country.

The Halsey scheme was devised by Mr. F. A. Halsey, while he was Superintendent of the Rand Drill Company, of Sherbrooke, Canada. The essence of the system is that a standard time is agreed upon in which a given job is to be done, and the workman receives an agreed percentage of the wages of any portion of this time he may save, in addition to the regular time rate for the period taken. An actual example will make the system clearer: suppose that a time limit set on a job is twenty hours and that the workman, by finishing the job in sixteen hours, saves four hours. Assuming that the agreed percentage he is to receive

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FARADAY'S ORIGINAL DISC DYNAMO

Royal Institution Collection. (*Reproduced by permission from "Fielden's Magazine"*)

of the time saved is 50 per cent and that his hourly wage on a time basis is 2s. per hour, then his wages for the period occupied by the above job will be as follows—

$$\begin{aligned} & 16 \text{ hours @ } 2\text{s. per hour} + 50 \text{ per cent of the} \\ & \quad 4 \text{ hours saved,} \\ & = 32\text{s.} + 50 \text{ per cent of } 8\text{s.,} \\ & = 32\text{s.} + 4\text{s.} = 36\text{s.} \end{aligned}$$

The Rowan system was introduced by Mr. James Rowan, of David Rowan & Sons, Glasgow. This is a complicated system under which, if a workman reduces the time he takes to do a job by a certain percentage, he gets an equal percentage of increase in his hourly rate. Thus, if a workman whose rate is 2s. per hour finishes an 8-hour job in 6 hours—thereby saving 25 per cent of the time—he receives the hourly rate for 6 hours, that is, 12s. + 25 per cent, or 3s., thus making a total for the job of 15s., and the time rate, therefore, 2s. 6d. per hour, or 20s. per 8-hour day. It will be seen that under the Rowan system, savings of time result in smaller premiums to the worker than under the Halsey system, so that the Rowan system tends to protect firms which are unable to set accurate premium times.

Premium bonus systems in this country have been very limited in their application, largely because of their complicated character and of the opposition of workmen to the systems—opposition largely brought about because of the difficulty they experience in calculating what their week's earnings should be in any given case. It may be affirmed that no system of wage payment is successful if the man who is being paid by it does not clearly understand the method by which his wage is calculated. Premium bonus systems are therefore more applicable to workers of high intelligence than those of lower grades.

OTHER SYSTEMS. It is beyond the scope of these

pages to analyse the innumerable systems of wage payment which have been devised from time to time. The differential piece work system, devised by Mr. F. W. Taylor of "scientific management" fame, is of more importance in America than in this country, for although in England modified forms of this system have been considered, it has been with very little practical result.

The sliding scale system of wage payment is worthy of note, as it has important application in the iron and steel industries in this kingdom. The selling price of the commodity at a certain time is taken as the basis for the scale, and workers receive an advance in wages in accordance with increased prices obtained by the employer. The iron and steel trades have worked according to this method for nearly fifty years, with apparently excellent results, giving satisfaction to both workers and employers, but it is generally felt that it is the special conditions of these industries that render the sliding scale successful.

TRADE UNIONS

Labour is organized through the medium of trade unions. An historical survey of the growth of trade unionism is outside the scope of these pages, but such an analysis would show that the modern trade union is an outgrowth from early guilds of workers, although by reason of the changed character of industrial conditions and consequent adaptation of labour organizations it is practically impossible to casually recognize much resemblance between the trade unions of to-day and the guilds of a few centuries ago.

A trade union is an association of people who combine together to protect and advance their trade interests. There is nothing to prevent an association of employers being a trade union, but common usage has rendered

the term generally applicable to combinations of work-people. The primary function of the trade union from a worker's point of view is to increase his bargaining strength when determining conditions of work with his employer. The commonly known sphere of trade union action is matters relating to wages and hours of work. But, in addition, several of them undertake valuable friendly society functions, and many of them make systematic payments to members who are out of work or ill, or even provide old-age pensions. Trade union funds are obtained through the payment of a regular weekly subscription by all members, and in addition a levy is frequently made for varying periods when heavy demands are made on a union's funds on account of unemployment or other reasons. The unions comprise branches, district offices and national headquarters. Individual trade unionists are in the first place members of a branch, which has a suitable meeting place where meetings of members are regularly held, the affairs of which are controlled by a branch secretary. Trade union branches are next organized into districts, with a district office and permanent secretary, the latter official frequently exercising a strong influence throughout his area. The national headquarters of the union is usually situated in London, although some unions have their headquarters in large industrial centres, like Manchester or Birmingham.

The working class movement, or as generally described "the labour movement," has both industrial and political activities. The Labour Party represents the latter, while the trade unions primarily represent the former. As we shall later see, the two functions of these bodies frequently coalesce and overlap, and it becomes difficult in cases to say where one function ends and the other begins, but it can be definitely affirmed that the first and most important concern of trade unionism is industry and not politics.

Trade unions in working to obtain advantages or concessions for their members from employers, have developed an elaborate procedure in collective bargaining. Many matters of local concern are settled locally and without difficulty: but there is a marked tendency for local matters to become national issues and then bring the national machinery of trade unionism into play. The recommendations of the national executive of the trade union concerned, after conference with the employers' representatives, pass through to the branches, where members, through the ballot, give instructions to their executive respecting acceptance or rejection of proposed terms.

The strike is the final attempt of trade unionists to obtain their demands when the latter are not conceded through ordinary negotiation. The converse of the strike is the lock-out, when employers refuse to give work to trade unionists until certain agreements have been made. Unions declaring a strike among their members pay the latter strike pay out of their funds during the period that the strike lasts. The Trades Disputes Act secures immunity for the trade unions and their funds, in respect of damage done during strikes and lock-outs, only the several individuals who do them being held responsible. When a strike is declared, trade unions appoint "pickets" to ensure that everything is done to secure the success of the strike by preventing other men, called "blacklegs," from doing the work from which the unionists have absented themselves, or their own men from returning to work before the appointed time. Picketing is lawful provided it is limited to disseminating information respecting the causes and progress of the strike, and to persuading strike-breakers in a peaceable manner to abandon their object.

The effect of public opinion on trade disputes cannot be ignored as it is increasing in importance. Every

effort is made by the parties in a dispute to place the reasons for their action before the public, who, largely through the medium of the Press, are able to give an opinion as to the side on which justice lies.

From a judicial aspect the State has always been interested in trade disputes. Since 1896, the State, through the Board of Trade, has been ready to approach parties in a trade dispute with a view to conciliation, and in 1911, a joint panel of employers and representatives of labour was established with a permanent official of the Board of Trade as Chairman. Since the formation of the Ministry of Labour in 1917, that Department has been the representative of the State in matters relating to Labour.

The Industrial Courts Act of 1919, expresses the most recent legislation respecting industrial disputes. "A permanent Industrial Court has now been set up to which disputes can be referred for settlement at the joint request of the parties concerned, but both employers and workpeople are encouraged to settle their differences by negotiation and conciliation, and the Act provides that unless the Minister of Labour is satisfied that, in respect of any dispute, all available means of settlement by the parties themselves have been exhausted, the matter shall not be referred to the Industrial Court for arbitration."¹

We have referred to the scope of trade unionism as being mainly industrial, and we now have to consider what may be described as the crown of the industrial activities of trade unions—the Trade Union Congress. The Trade Union Congress was brought into being in 1868, at Manchester, when delegates appointed by trade unions considered matters relating to the co-ordination of trade union work and policy. A few years later a Parliamentary Committee was appointed, and to-day the Trade Union Congress Parliamentary

¹ *Employers' Year Book*, 1920.

Committee not only prepares Bills for laying before Parliament, but closely examines all legislation affecting Labour in order to protect the interests of the working classes. Through the medium of the Trade Union Congress the public has learned more of trade union objects than by any other agency. At the Jubilee Congress held at Derby in 1918, 881 delegates were present, representing an affiliated membership of 4,532,085, organized in 264 trade unions. To-day the membership is over 5,000,000.

Joint action among all sections of organized labour is increasing, as is also the tendency of the small unions to amalgamate. Of the latter tendency, the formation of the new Amalgamated Engineering Union is the most recent example. The increasing size and power of the national federations of labour, such as the miners, transport workers, engineers, and the textile workers, give great power to the Trade Union Congress, which can be regarded as speaking authoritatively for the world of labour.

INDUSTRIAL COUNCILS AND WORKS COMMITTEES

So far we have been considering organizations of labour and have had occasion to refer to organizations of employers, but in both cases have viewed them rather as parties in collision and in a state of struggle than as working jointly and harmoniously for a common end—the public good. In order to keep before both employers and employed this latter aspect of the industrial problem, various voluntary organizations have been established with a view to bringing the two great partners of industry into closer touch by emphasizing matters of common and mutual interest instead of dwelling on only those phases of industrial relationships which provide occasions for dissension and antagonism. The National Alliance of Employers and Employed, and the Industrial League and Council

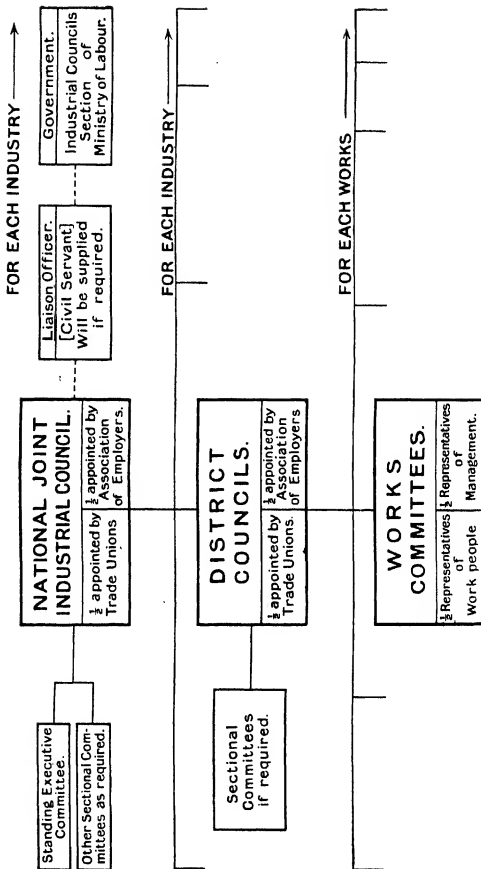


FIG. 7.—CHART SHOWING WHITLEY SCHEME

are chief of these organizations. The second of these bodies was definitely established in order to advocate and assist in the formation of Whitley Councils, as outlined in the Whitley Report.

The Whitley Report, issued in 1917, contained the recommendations of a Government Committee having the following terms of reference—

(1) To make and consider suggestions for securing a permanent improvement in the relations between employers and workmen.

(2) To recommend means for securing that industrial conditions affecting the relations between employers and workmen shall be systematically reviewed by those concerned, with a view to improving conditions in the future.

The Report recommended the establishment for each industry of a triple organization—in the workshops, the districts and nationally, to be known respectively as Works Committees, District Councils, and Industrial Councils. The organization at each stage is to be composed of representatives, in equal number, of workpeople and employers. The attached chart indicates in diagrammatic form the construction of these organizations (Fig. 7). The Government has adopted the recommendations of the Report as part of its policy, and the establishment of Whitley organizations have proceeded on a systematic basis.

Works Committees have accomplished useful work in most cases where they have been established. Subjects for discussion extend over a wide range, including, for example, conditions of employment, better utilization of experience of workpeople, the adjustment of earnings and piecework prices, the provision of educational facilities, and improvements in processes, machinery and organization. Most important among the results of Works Committees is the creation of an atmosphere suitable for reasonable discussion between employers and workpeople.

CHAPTER VIII

MANAGEMENT

MANAGEMENT is that part of the factory organization which co-ordinates, directs and controls the activities of all other sections. It is directly answerable to the representatives of the capital invested in the concern, namely, the directors and shareholders, for the success of the factory as a manufacturing unit, and for the efficient marketing of the products manufactured.

The management of large industrial concerns has gradually developed from small beginnings in private works. In the early days of the factory system, the proprietor of a factory personally undertook all management problems relating to the manufacturing, commercial and financial branches. In the modern organization, capital is supplied from outside the undertaking, and a "management" class has arisen, of men who are familiar with the technical processes of manufacture and with matters relating to the progress of the industry.

ADMINISTRATION

The relations between the directors of a concern and its management members vary from factory to factory, but certain general practices may be stated. The primary function of directors is to safeguard the interests of shareholders. In small works the directors are frequently also members of management, and serve in an executive capacity in the factory organization. In these cases, the directors receive a salary in payment for their managerial services in addition to emoluments accruing from membership of the Board of Directors. Such a firm enjoys special advantages, for valuable practical experience is in this way brought to bear on the policy of the concern.

In large concerns the Board of Directors usually appoints a Managing Director, who possesses supreme administrative control, and is responsible to the Board for the success of the undertaking. The Managing Director may either personally supervise the work of a number of managerial officers, or he may delegate most of his functions to a general manager, to whom the company's principal officers report.

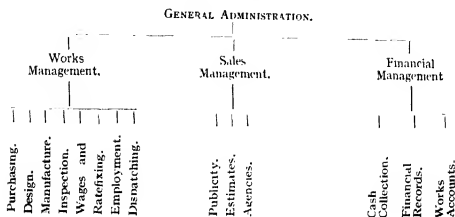


FIG. 8

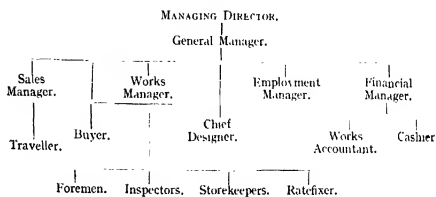


FIG. 9

Figs. 8 and 9 illustrate the broad functions and staff distribution of management respectively.

The first of these diagrams illustrates the broad three-fold function of management, namely, the organization of works, sales and finance, the more important branches of each of these three divisions being also indicated.

Figure 9 showing the organization of personnel, illustrates a typical case, and cannot be regarded as

exhaustive, since practically no two manufacturing concerns are absolutely identical from this point of view.

The example quoted assumes a general manager reporting to a managing director, with a departmental manager in charge of each of the three broad sections, works, sales and finance. The financial manager, in view of his extensive interests in the company's financial records, usually has ready access to the managing director, and can be regarded as reporting in part to the managing director and in part to the general manager. There is a link between the financial and works organizations of a factory in so far as works accounts are concerned, which is supplied as a rule through the works accountant, who, while a member of the financial organization, closely co-operates with the works officials. Further, although *prima facie* the chief designer and the buyer fulfil works functions, yet their influence on the commercial and financial aspects of the company's concerns can be so pronounced that it is usual for these two officers to report direct to the general manager and at the same time maintain close co-operation with the works manager.

The Employment Department, which is responsible for the selection of workers, for their transfer, promotion, etc., admits of considerable variety of organization. In some concerns it is an integral part of works management, and independent of both the commercial and financial organizations. In these cases, the Employment Department usually restricts its activities to the engagement of workmen for factory employment, and does little in respect of the appointment of technical staff for the commercial and financial branches of the concern. There is a marked tendency, however, at the present time to centralize the selection, training and promotion of all grades of staff, and to organize this work in an Employment Department, the head

of which reports direct to the General Manager, or even to the Managing Director. This type of organization is usually adopted in order to conserve to the utmost the labour force, and wherever possible to fill vacancies by promotion from among lower grades of work. Companies adopting this practice recognize the fact that stability of factory personnel, that is, low labour turnover, is an essential requirement to economic production.

SCIENTIFIC MANAGEMENT

Scientific management is a term which has come into prominence in recent years, and owes its inception to work undertaken by Dr. F. W. Taylor in the United States some twenty-five years ago, the results of which he propounded in a paper entitled "A Piece Rate System: being a step towards partial solution of the labour problem." He outlined a method of fixing piece work prices by means of splitting a job up into its component parts and pre-determining a time allowance for each part of the job. The Taylor system of working involved the determination of the best way of doing a job, the elimination of all unnecessary efforts, and the reduction of fatigue on the part of the worker to an absolute minimum. These factors may be more completely tabulated in the following manner—

- (1) The analysis of a job into its elemental operations by means of an investigation into the best method of accomplishing the desired result.

- (2) The execution of the job by a first-class man with tools and equipment of the best possible, and the timing of each elemental operation thus carried out.

- (3) The investigation of the factors of environment and nature of the work as it affects the physical and mental condition of the worker.

These factors are usually referred to as Motion Study, Time Study and Fatigue Study, respectively.

MOTION STUDY. While Taylor indicated the problem of motion study, Mr. Frank Gilbreth has developed methods to a much greater extent, and applied them widely in his own craft of bricklaying.

Motion study has been more generally applied in the States than in this country, and the few attempts made in this country to introduce its principles have usually met with strong opposition on the part of workers. This opposition is frequently the result of an unwise plan of approach on the part of those introducing motion study. It is a safe maxim that in all cases new experiments in management should be preceded by a long period of education in which the workers are given ample opportunity of understanding, discussing and criticizing the proposed innovation, of which the advantages both to themselves and to the community at large are adequately explained.

Motion study necessarily results in increased output, since, by the elimination of unnecessary operations and wasteful motions, a greater amount of work can be done by an operative in a given time, and in many cases with less effort. "To suppose that skill cannot be communicated or assisted by instruction is to place a serious limitation on industrial development; for one of the most striking developments in modern management is the application of the highest intelligence to the guidance of workers of the lowest intellect, there being no loss of directive power through the order passing from the executive through a number of grades of workers before it reaches the individual effect."

One effect of motion study is to facilitate the solution of the problem of the length of working day in order to secure optimum effort from the worker while at the same time incurring only a reasonable expenditure of energy. It is clearly unwise to spend say twelve hours in work which properly studied could be done as

efficiently in six hours. It is probable that as this inquiry is pursued further it will be found that no one standard length of working day will be agreed upon, but will vary from trade to trade according to the nature of the processes and the character of working conditions.

TIME STUDY. Motion study and time study are but two aspects of a common problem, and it is practically impossible to dissociate these two closely related problems. Motion study primarily refers to the operative, and time study to the machine operated. The function of time study is to analyse in close detail the manner in which every unit is spent in performing a job, and includes time studies of such factors as the handling of tools, machines and materials, and the time required to perform various machine or hand tool operations. Machine tool work naturally lends itself to the most highly scientific analysis, but the same principles equally apply to fitting, assembling, and all hand operations. Motion and time study give the minimum time in which a job can be done under the best possible conditions, excluding time spent in rest intervals. There can be no doubt that at one time in the United States the enthusiastic pioneers of motion and time study carried their zeal to excess and allowed their investigations to result in the over-driving of workers instead of their protection, as was their declared object, and so acute did the situation become from the point of view of workers that legislation was enacted prohibiting in the United States the use of stop watches in connection with factory and workshop processes.

INDUSTRIAL FATIGUE. The system of management propounded by F. W. Taylor, and already referred to as scientific management, called attention for the first time to the problem of industrial fatigue. It was declared by the originators of the new

system that efficient work could not be expected from operatives unless due provision was made for rest periods at frequent intervals, so that workers, naturally tired after a period of continuous effort, could recuperate and proceed again with normal effort. But the problem of fatigue, while having a specific application in connection with the type of management under consideration, has a very general application throughout the whole of industry and cannot to-day be ignored by the student of industrial management. Fatigue is caused by the accumulation in the blood of toxic products arising from nervous and muscular activity and the continuance of work without intermittent rest periods results in an accumulative clogging of the tissues to such a degree as ultimately to cause complete stoppage of the human mechanism.

In all forms of human activity it is essential, therefore, to provide a suitable alternation of working and rest periods, so that during the rest period the poisonous products arising in the body as a result of active physiological processes may be removed. Physiological research shows that longer periods of rest are necessary after night and week-end work than required by week-day work only. This forms the argument for avoidance of overtime and Sunday work and for works holidays.

Numerous examples are available of increased productive capacity resulting from the appropriate adjustment of work and rest periods. One such example can be quoted in which girls engaged on monotonous work at a bleachery were allowed three rest periods per day, each 45 minutes, one being for dinner. When these times were rearranged so that they had 80 minutes work and 20 minutes rest throughout the day, the output went up 60 per cent. An arrangement of spare hands prevented machines being idle.



A MODERN ELECTRIC GENERATOR

Developing 25,000 kw. at 1,500 revs. per min., and contrasting with Faraday's Dynamo shown on page 99

There is a marked correlation between fatigue and the incidence of accidents in factories. In fact, so pronounced is this that the latter is used as a measure of the former, and this constitutes the first non-laboratory method of measuring fatigue. Another method of determining fatigue is by measuring output, as clearly the increase of fatigue causes a diminution of output. The best way of applying this method is to take a standard product and measure the amount produced during equal intervals, say of one hour, over the whole period of the working day. The most common laboratory method of fatigue measurement is the ergograph, which was devised by Dr. Mosso. In this apparatus the hand is fixed palm upwards and a string attached to the middle finger, the vertical movement of which raises and lowers a weight and thereby makes a mark on a revolving drum showing the height the weight is raised. The height rapidly falls off as fatigue increases. These methods of measurement apply to physical or nervous fatigue resulting from muscular exertion. Mental fatigue may be measured by the accuracy of performance of simple mental tests extending over a sufficiently lengthy period to allow fatigue to operate.

Although the above analysis of time and motion study and fatigue have been occasioned by a reference to scientific management, the field of their application is in no way prescribed solely by their relation to scientific management.

The study of these problems arises from a consideration of the human factor in industry, and scientific management itself is open to the criticism that in many instances it tends to ignore or to insufficiently regard the importance of the human factor. In fact, Dr. Taylor himself declares that his system of management should be greater than the man. Reference has already been made to the selection and training of

factory personnel, and the present inquiry into other phases of the human factor only serves to throw into greater prominence this important aspect of the function of management.

INDUSTRIAL RESEARCH

Another function of management is manifested in industrial research, and probably greater advance has been made in recent years in the application of scientific principles to the development of industrial processes than has been made in the various human problems associated with time and motion study and industrial fatigue. Industrial research is carried out in a modern works either directly through an organization of its own or indirectly through a Research Association. The prime function of industrial research is to provide new knowledge which will help industry in extending the application of its manufacture and turn to greater economic account its various raw materials, and at the same time, in any one organization, to take advantage of new knowledge obtained outside the concern by developing facilities for keeping in close touch with advances in pure and applied science.

In distinguishing between research work in pure science and industrial research, it may be observed that while both are essential to industrial progress, the former widens the boundaries of knowledge by formulating principles, while the latter is directed towards the solution of particular industrial problems, or towards meeting some industrial need.

“Research laboratories partly or wholly supported by industrial firms may be broadly classified according to the particular interests they are intended to serve, as for example—

(1) “Industrial research laboratories self-contained and serving one particular works.

(2) "Central industrial laboratories, each forming the scientific focus of an industrial organization comprising several works, often in different industries, and linked up by control laboratories at the individual works. The function of the central laboratory is to conduct research bearing on the manufacturers of all the works, and that of each control laboratory is to serve the immediate requirements of the works to which it is attached.

(3) "Laboratories planned to serve a wide range of interests in various industries in connection with isolated problems, such as the Mellon Institute of Industrial Research, Pittsburgh, or ordinary commercial laboratories, such as that of A. D. Little, Inc., Boston.

(4) "Laboratories designed to serve the needs of one particular industry working on a co-operative basis, such as the Laboratory of the National Canners' Association, U.S.A. The laboratories of the proposed Research Associations in Great Britain would fall into this class.

(5) "State laboratories, carrying out researches occasionally of an industrial character but not necessarily for any particular firm, such as the National Physical Laboratory, the Bureau of Standards, U.S.A., and various university laboratories."¹

It is usual for industrial concerns, especially those commencing research work, to combine routine testing of their raw materials and semi-finished and finished products with research work, largely for reasons of economy. As research develops, it gradually becomes dissociated from routine test work, and develops along special lines.

Where firms are not of sufficient size to justify the

¹ Fleming, "The Planning of a Research Organization." *Proceedings, Institution of Electrical Engineers.*

establishment of research schemes on their own premises, they frequently combine for this purpose. The Department of Scientific and Industrial Research, with its large Treasury grant is endeavouring by the establishment of Research Associations to develop means whereby co-operative research can be established in various industries with the initial assistance of Government funds.

CHAPTER IX

THE STATE IN RELATION TO INDUSTRY

IN tracing in an earlier chapter the historical development of industry, it was noted that even in its early stages the general public, as represented by the Government, took a keen interest in the regulation of industry so as to ensure that adequate services were rendered, and these under satisfactory conditions. Industrial legislation has therefore aimed at attaining, on the one hand, the protection of the producer from overwork, unhealthy conditions and underpayment, and on the other hand, the safeguarding of the public interest by prohibiting the marketing of certain unsatisfactory products. In particular in connection with articles of food has this safeguard been exercised.

The interest of the State in industry is expressed through a number of Acts of Parliament, ranging from the earliest Factory Acts which have been amended at frequent periods, to more modern legislation of Minimum Wages, Health and Unemployment Insurance.

THE FACTORY ACTS

The present code of Factory Act requirements is primarily based on the Factory and Workshops Act, 1901, and relates to all factories and workshops, irrespective of their size, in which manual labour is employed in the pursuance of trade for the purpose of profit making. Under the Factory Acts, workshops and factories are divided into two main groups, textile and non-textile respectively. The term "textile factory" refers to premises in which power is used to operate machinery for the manufacture of textiles of all types. In defining "non-textile factories,"

the Factory Act sets out a specific list of types of work included under this classification.

It is impossible in the present space to outline in detail even a summary of the main requirements of the Factory Acts, but of the outstanding provisions the following may be mentioned. In the first place, a tenant in entering upon the occupation of premises that fall within the meaning of the Act, is required to send notice of such occupation to the District Factory Inspector, and at the same time to fill up a prescribed form supplied by the Home Office which outlines the exact character of the work which is to be undertaken in the factory and gives such other information as the form requires. This information when received by the Home Office is abstracted, and a copy of what is officially described as the "Abstract" is sent to the occupier of the factory, to be displayed in a prominent position on the factory premises after the requisite entries and signatures have been made in the blank spaces.

Included under "Special Provisions as to Health" are provisions relating to the cleanliness of factories in order to safeguard the health of the workers, which deal with such matters as minimum air spaces and adequate ventilation, the maintenance of suitable and uniform temperatures, the painting of the factory at fixed periods, and the provision of meal rooms, washing conveniences and sanitary accommodation.

The "General Provisions as to Safety in Factories" relate to the fencing of moving parts of certain types of machinery, to the prohibition of machinery being cleaned whilst in motion, except under certain conditions, and to the restriction in the use of dangerous machinery. Certain clauses relate to steam boilers, and usually the Certificate of an Insurance Company is accepted as sufficient in this respect. It is required that adequate means of escape be provided for use in

WORKMEN'S COMPENSATION

For many years the principle has been recognized of compensating workpeople injured in the course of their occupation. In 1880, the first Employers' Liability Act was passed, in which the liability of employers was limited to accidents causing injury or death brought about by defects in works or in machinery due to the employer's negligence, compensation was provided in the form of a lump sum of money.

An Act passed in 1897 extended the scope of the earlier measure, and in 1903, a departmental committee reviewed the experience obtained through the working of these Acts, with the result that a new Act was passed in 1906, the Act which still operates at the present time. This Act extended the principle of compensation to practically every type of employment, only seven classes of persons being excluded. Compensation in the case of injury consists of weekly payments of an amount equal to one-half the average earnings during the previous twelve months, or such shorter period as the injured person may have been employed. Compensation, in the case of death, is an amount equal to three years' earnings or £150, whichever is the greater, with a maximum of £300. Disputes are to be settled by arbitration, and in practice the County Court Judge has become the arbitrator, and is also enabled to appoint a medical referee.

The financial burden which workmen's compensation imposes upon employers is largely accepted in practice by Insurance Companies. In 1919, sixty-five Joint Stock Companies insured employers with a wage roll of £600,000,000 a year at a premium of £5,000,000, an average of 16s. 8d. per £100, and fifty Mutual Indemnity Associations insured their own members at a cost of £2,000,000 a year. In the case of exceptionally large companies, such as the great railways, their wage bill

is sufficiently large to relieve them from the necessity of insuring at all, and it is estimated that, at the present time, workmen's compensation costs these companies an aggregate of £1,000,000 a year.

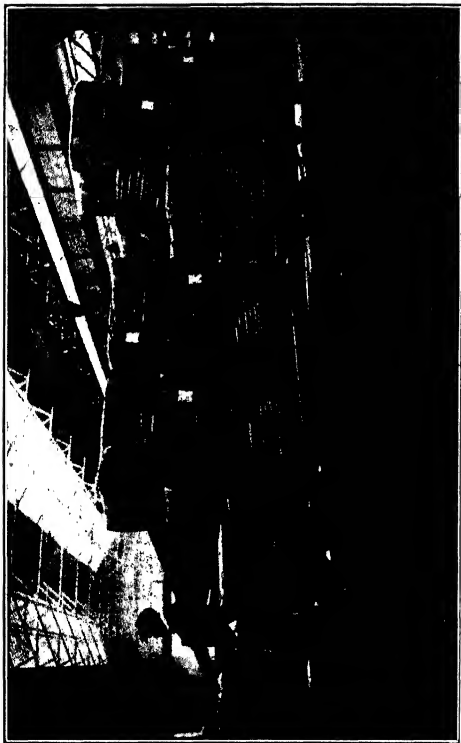
Further legislation respecting workmen's compensation will doubtless be enacted in the near future, and the recently published Report of the Departmental Committee on Workmen's Compensation, a Committee appointed by the Home Secretary in May, 1919, may be regarded as the forerunner of legislation.

This Report advocates the continuance in general principle of the present system, but recommends a more liberal scale of award, together also with a closer control by the State of those Insurance Companies who accept responsibilities of employers respecting workmen's compensation.

MINIMUM WAGE LEGISLATION

In those industries where strong organization does not exist, the State has stepped in and enacted legislation; in the first place to prevent the sweating of workers and to assure to those engaged in these trades a certain minimum wage, which latter is regarded as being a living wage. In one special trade, the mining industry, legislation has been introduced in order to safeguard workers who carry on their work under hazardous and exacting conditions and not primarily to assure them a minimum rate of wage, as the latter is already of a satisfactory amount.

Minimum wage legislation is contained in the Trade Boards Acts, 1909 and 1918. These Acts provide for the establishment of Trade Boards, whose function it is to fix for certain trades minimum rates of wages, which, after confirmation by the Minister of Labour, must be paid by all employers in the trade and are enforceable at law. Trade Boards are set up as the result of an order made by the Minister of Labour,



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but public notice of the intention to make such an order has to be given and forty days' notice granted, during which time objections may be lodged. If objections are received, the Minister of Labour is required to have a public inquiry made to decide whether or not a Trade Board should be established. Trade Boards are composed of equal numbers of representatives of employers and employed under a neutral chairman. To this number may be added two or four persons not associated with the trade, which people are known as "Appointed Members." It is usual to have at least one woman representative on Boards in trades where women are employed.

When a Trade Board decides to establish a new rate of wage or to alter an existing rate it is required to send notice of the proposed change to every employer in the trade concerned, when posters are exhibited in the works setting out the new rates, so that workers may have the opportunity of considering them. One month is allowed in which objections may be lodged and in the event of none being received, the Minister of Labour confirms the rates, after which they become law.

The working of Trade Boards during the past ten years has resulted in the rates of pay of low grade workers being improved and has practically eliminated sweated trades. In the direction of improved organization among employers and employed Trade Boards have had a marked effect, and it is noticeable that in some trades—for instance, tailoring—trade unionism has made rapid strides since their establishment.

HEALTH INSURANCE

The National Insurance Scheme was brought into effect in the Act of 1911, Part I of which required that for purposes of health insurance all persons in receipt

of an income less than £160 per year, provided they were over 16 years of age, became insured persons. The insured person paid 4d. per week if a man, and 3d. per week if a woman, 3d. per week being paid by employers in respect of persons in their employ. Where a worker earns less than 15s. per week, a reduced contribution is required, although the employer pays an increased amount. The rates of contribution have been altered from time to time. Health insurance payments are made by means of stamps affixed to an insurance card, which every insured person must possess, and these stamps are obtainable at the Post Office. Persons in receipt of less than £250 per year are now insured persons.

Benefits under the Act include medical treatment and attendance in all ordinary circumstances, sick benefit commencing from the fourth day after an insured person is rendered incapable of work and continuing for a period not exceeding 26 weeks. Ordinary rates of sick benefit are 15s. per week for men and 12s. per week for women, with the exception that persons who have been insured for a less period than two years receive a rate of 9s. for men, and 7s. 6d. for women. Disablement benefits of 5s. per week in both cases are provided after 104 weekly contributions. There are also maternity benefits and provisions relating to cases of tuberculosis.

It is estimated that the benefits under this scheme, which in the year 1913-14 were over £15,000,000, will increase by gradual increments to more than £25,000,000 by the year 1932-33.

UNEMPLOYMENT INSURANCE

Part II of the National Insurance Act, 1911, relates to Unemployment Insurance, and the provisions of this section of the Act only compulsorily refer to

certain specified trades, although voluntary insurance for purposes of unemployment is encouraged among all workers by State contributions to approved societies. The specified trades include—building, construction of works, shipbuilding, engineering, ironfounding, construction of vehicles and saw milling. It is thus possible for a workmen having to transfer between trades sometimes to be insurable and at other times uninsurable. This more usually occurs in the case of unskilled than skilled persons.

The Unemployment Insurance Act of 1920 extended the scope of unemployment insurance to non-manual workers who are in receipt of wages not exceeding £250 a year. Contributions for Unemployment Insurance were 2½d. per week from the workman and 2½d. from the employer, special conditions pertaining where the duration of employment has been less than a week. In the 1920 Act, unemployment benefit is increased to 15s. per week for men and 12s. per week for women, and benefit becomes payable from the fourth day of unemployment. Provision is also made for approved societies to act as Government agents. Moreover, if employers and employees, between them, desire to do more than is required by the Act, provision is made for special schemes. It is estimated that under the present Act the number of persons compulsorily insured against unemployment becomes increased from 4,000,000 to 12,000,000.

The scale of contributions has more than once been increased, and at present an insured man pays 9d. per week and the employer 10d. per week; an insured woman pays 7d. per week and the employer 8d. per week. Lower rates apply in the case of youths and girls.

Also benefits have been increased, extra provision being made for married men and also for those with children.

LABOUR EXCHANGES

In order to mitigate the evils of unemployment and to provide a suitable centre for the payment of unemployment insurance, Labour Exchanges were established by the Labour Exchanges Act, 1909. This Act empowered the Board of Trade, whose work in this respect was undertaken in 1917 by the newly formed Ministry of Labour, to set up and maintain Labour Exchanges in such places as they thought fit. The object of a Labour Exchange is to provide a meeting place for men who are out of work and employers who want additional workers, and clearly the Exchanges can only work efficiently if both workers and employers avail themselves of such facilities. In some cases, often where seasonal trades are concerned, employment is available for numbers of men in another town or district from that in which they are at the time living, and where employment in another district has been found for them through a Labour Exchange, the Ministry of Labour has power in certain cases to make advances to workpeople by way of loan towards meeting expenses of travelling to such places.

It is provided by regulations that no person is to suffer any disqualification on account of refusing to accept employment found for him through a Labour Exchange where the refusal is due either to a trade dispute or to the wages offered being lower than those current in the trade in the district of employment. Advisory Committees have been established in many cases to advise and assist respecting the management of Labour Exchanges.

In 1910 the facilities of the Labour Exchanges were extended to juveniles under the Education (Choice of Employment) Act. The Juvenile Employment Bureaux which were set up in consequence,

assist by collecting information relating to juvenile employment and communicating this to young persons in search of employment, and also to boys and girls before they leave school. The Juvenile Employment Bureaux do good work in advising parents respecting the employment of their children.

CHAPTER X

THE TREND OF INDUSTRY

THE history of industry in this country falls into certain well-defined periods, each of which is marked by some dominant idea or characteristic. Thus, there was a period in which industry was conducted on "domestic" lines—a later period in which the "guild" system flourished—then came a remarkable period which commenced with the development of the steam engine and its application in industry, and ended with the outbreak of war in 1914. This was a period in which great inventions were made, most of which added incalculably to the material well-being of the people. Transport by means of railways and steamships became available, and during the period enormous improvements were made in the facilities they provided. Quick communication became possible through the medium of the telegraph and telephone. The use of electric light and power added many comforts and conveniences to everyday life. The development of the internal combustion engine was the basis for the motor-car industry, and made mechanical flight ultimately possible. All these inventions and developments, in addition to adding to human comforts, were the foundation of the creation of an enormous amount of wealth and represented the biggest factor in sustaining an enormously increased population. The predominant characteristic of this period was materialism.

The succeeding industrial period extends through the years of the war and covers a marked transition in the social and economic aspect of our life. It was a period of great destruction, but was marked also by great creative power. From the materialistic point

of view, the rate of production of commodities was enormously accelerated, and within a space of a few years developments took place which in normal times would have extended over several generations. The laws which underlie social and economic changes are ordinarily not discernible until after the events that they govern, but such changes have in the past occurred at such a slow rate that the causes have been sufficiently well understood as to afford guidance for the succeeding developments. In the war period, however, changes took place with such rapidity, and the economic and social upheavals which occurred were such that the underlying causes of each are not yet clearly discernible. The reaction of the war has disclosed an insufficient appreciation of fundamental economic principles on the part of the great majority of industrial workers. Moreover, large sections of the population have displayed a lack of will to curb the habit of extravagance developed during the war time, and an apathy in connection with effort which should be directed to more productive enterprise.

The termination of the war is the beginning of the new industrial period, which, though it must of necessity deal largely with the material aspect of affairs in connection with the reconstruction of national assets, and the establishment of social and economic functions on a more stable basis, will, it is already discernible, be dominated by an essentially ethical characteristic as compared with the materialism of the pre-war period. Industry in pre-war times afforded a means of existence to the population. In the new period it will have to provide not only existence, but also a means for the higher development of mankind, and throughout all industrial life increasing attention will be paid to the human element. This will necessitate far-reaching social reforms, which in turn will require an increased expenditure of money.

Hence, the new industrial period will be such as to involve an equilibrium between attention to material and ethical aspects. Already much has been done to strengthen this new dominant characteristic. Working conditions, for instance, are being continually improved, and the introduction of the word "welfare" into the industrial vocabulary points the way of recent developments. The earlier chapters have given sufficient indication of other improvements, the selection of employees with due attention to their particular working capacities, the shortening of the hours of labour, the new channels for articulation provided by works councils. Legislative and other efforts tend to make education more general and available to all members of the community. Industry in the future will proceed only under a wise direction which gives adequate consideration to both material and ethical views, and in progress along these lines a number of concomitant factors will have to be taken into account, notably the improved facilities for production, the change in the character of management, education on the broadest lines, and the development of public opinion and political influence.

Social developments, the shortening of hours of labour, and the provision of means for education and artistic culture in this new period will involve a heavy expenditure of money. All wealth comes from the conversion of nature's resources into the commodities available for human use, and increased new wealth can be created to allow this increased expenditure only if an increasing quantity of natural resources is turned each year to human use. The processes of transformation must be made far more efficient by the increasing use of labour-saving machinery, and by the ever-increasing use of science. Widespread efforts have already been made to apply scientific research to the discovery of new sources of natural wealth, and

to the elimination of various forms of waste. The waste of human effort in industrial processes has, we have already noted, been scientifically studied by American investigators. Greater knowledge is being obtained through scientific research of the characteristics and properties of materials of construction which results in improved strengths and effects economies in design. It would be rash to attempt to predict the inventions and discoveries that will be made during this new period, but there would appear to be some grounds for the belief that the rate of invention and discovery of the past will not be maintained, but rather that our great stores of scientific knowledge will be applied in the direction of increasing production and reducing the human effort expended in industrial processes. There is reason to expect that the body of wealth so created will be expended in supplying more fully the innate demand for the higher development of mankind, rather than in meeting only its purely material needs.

Considerable changes in the type of management of industrial enterprise may be expected, brought about both by a more enlightened and highly educated type of manager, and by a demand on the part of the workers for some share in management. It is being realized more and more that industrial management and organization can be reduced to something of the nature of a science in which every effort is directed to eliminating waste, whether of materials, time or human effort, and at the same time to preserving interest and unity among the various groups of workers. The new type of manager will have had a definite training for such work and will "sense" the spirit of the times and pay increasing attention to every factor which makes for the improvement of human relations in his work.

There is a very definite desire in the ranks of organized

labour for some share in the control of industry. At the same time, the positive demands of workers in this respect are nebulous, and apparently there is an entire lack of realization of the fact that a management requires to be trained and experienced in its work to a much greater degree than does a skilled workman in his, and without some form of training it is difficult to see just how labour can take much part in managerial affairs. A more logical demand would be the provision of increased facilities for allowing those of the rank and file who show ability and capacity to rise rapidly through the various grades of employment till they occupy the managerial positions for which they may thus become well fitted.

To some extent a voice in management is being heard through the channels provided by works committees, Whitley councils and industrial councils, and increasingly co-operation between employers and the enlightened sections of labour is taking place. One may hope ultimately to find adopted means whereby representatives of workers can be kept informed of the business and other phases of organization of a concern so that the real problem of producing efficiently can exercise the full efforts of both management and labour, and an end be made of the internal friction between the two parties which diverts much effort from constructive work.

Much attention is now being given to education, and particularly to continuation education, which will enable boys and girls on leaving school to receive a measure of education in working hours. While the first part of their continued education is of a general character, ultimately much of it should have a very direct bearing on the work in which the young people concerned are engaged. There is much to be done to educate everyone to the fact that industrial life should occupy a very prominent place in the whole life of a

citizen. There is a marked tendency at the present time on the part of educators and the public generally to regard industry as something entirely apart from the ordinary affairs of life, whereas it should be an integral part of their understanding that industry is that necessary foundation of our modern life which creates all wealth and supports the superstructure of all professional and artistic activities. The influence of industry on the worker, when this is understood, is of a high educational value in fitting him to discharge his personal, vocational and citizen duties. In many works there are schools to provide definitely for the education and training of their young workers. There are many agencies at work for providing adult education, and one may expect to find the number of classes and study circles increasing, all tending to produce in industrial workers a more balanced judgment, particularly on the economic aspects of life.

The many efforts which have been made during the past few years on the part of sections of the people to enforce their demands and interests on the whole community, regardless of the rights of the latter, have done much to bring the general public to the realization that they themselves are concerned vitally with industrial affairs. This may be expected to have a very healthy influence eventually in all those movements, whether of a local or national character, which may affect the well-being of industry, since it will be appreciated by the public that their own prosperity is to a very considerable extent bound up in the prosperity of the country as a whole. Much will doubtless be done through the Press, possibly through the churches, and through the home as well as the industrial life, to educate public opinion in regard to the attitude taken up by any organization, whether of employers or of labour, which is likely to react to public detriment.

Apart from the material wealth of the country as

represented by its minerals, its agricultural facilities, railways, steamships, etc., its most important assets are its people. The extent of these human assets has never yet been fully explored, although their wealth was in large measure proved during the late war. In the matter of physical endurance, of ingenuity in manufacture, of sustained effort in the production of munitions, and in the organization of industrial and other activities, the people of this country achieved extraordinary success. The great productivity during war time was in itself evidence of the latent possibilities inherent in the British people, and when the reaction of war has passed and the disturbed conditions have settled, and when social problems are viewed in their new and proper perspective, then we may reasonably expect to develop in a new manner the human assets of the country, and maintain for Britain the premier position among the nations which she has enjoyed for so long.

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